Mathematics is a basic tool for understanding the world, and it is a crucial requirement for many careers in science, engineering, business, and other professions. It is also a living, dynamic field of research. A successful math major represents a special combination of creativity and analytic rigor that is respected worldwide. Our students and faculty are constantly excited by the combination of internal beauty and powerful applicability that motivate our studies. It’s simply great stuff: challenging, fun, and vitally important to society.

There are three tracks in the major. **Program A** is designed for students who plan to work in industry or government or to pursue graduate study in mathematics. **Program B** prepares students who want to teach mathematics in secondary education. **Program C** combines mathematics with a specialization in a math-related area (for example, computer science, economics, physics, statistics). All three programs allow majors to earn a Bachelor of Arts (B.A.) or a Bachelor of Science (B.S.) degree.

The Mathematics Department encourages students to pursue interests in the many fields where mathematics is important, such as business and physical or social sciences. Graduate study is the expected route for college or university teaching and research, and it is advisable for certain positions in government and/or industry. While mathematics is not the most common route to careers in fields such as Law or Medicine, such professional schools – along with graduate programs in many other fields – do welcome mathematics majors. The key is to take courses in those areas to demonstrate interest and breadth of ability. The American Mathematical Society web page has valuable information about jobs for majors: www.ams.org/employment.

This handbook provides information about how to set up programs of study appropriate to student’s unique goals and offers some tips and useful information about scheduling, preparation for jobs or graduate school, special opportunities for research, scholarships, etc.

The Department of Mathematics is part of the College of Liberal Arts and Sciences (CLAS), so mathematics majors need to meet CLAS requirements as written in the University Catalog. This Handbook is available in the Mathematics Department office (14 MLH) and on the internet at [http://www.math.uiowa.edu](http://www.math.uiowa.edu). The department’s web site has additional information, including links to math-related sites as well as department news and activities. The faculty web pages provide their contact information and research interests; many also link to their personal web pages.

_Nondiscrimination Statement:_ The University of Iowa prohibits discrimination in employment or in its educational programs and activities on the basis of race, national origin, color, creed, religion, sex, age, disability, veteran status, sexual orientation, gender identity, or associational preference. The University also affirms its commitment to providing equal opportunities and equal access to University facilities.
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NOTE: During the year, corrections or policy changes may be necessary, so students and advisors should check occasionally for updates. Please email any suggestions for improving this Handbook to Prof. Oguz Durumeric, oguz-durumeric@uiowa.edu or mathematics-department@uiowa.edu.
DEPARTMENT ADMINISTRATION

The Mathematics Department has a Chair (Dr. Daniel Anderson) and two Associate Chairs (Dr. Laurent Jay, Director of the Graduate Program, and Dr. Oguz Durumeric, Director of the Undergraduate Program). The faculty elects its Undergraduate Committee (likewise a Graduate Committee) which examines and recommends course development, course offerings, and academic policies. Day-to-day decisions implementing Department policies are made by the Program Directors or at the Committee level. The Committees make policy recommendations to the Department faculty.

The Mathematics Department is proud of its excellent support staff. Margaret Driscol handles the department’s budgets and is the person to see about scheduling a meeting with the Department Chair. Cindy Van Ark works primarily with the graduate program and its students. Christina Brenneman is the department’s receptionist and works closely with the undergraduate program.

People to Contact

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Office</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
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<td>Chemistry and Computer Sci.</td>
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<tr>
<td>Cynthia Farthing</td>
<td>Director, Math Tutorial Lab</td>
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</tr>
<tr>
<td></td>
<td>Math Placement Coordinator</td>
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FOR ALL UI STUDENTS
MATHEMATICS PLACEMENT

Mathematics placement tests are the most accurate if they are taken shortly before enrolling in a mathematics course. Since mathematics courses build on one another, students who have not taken a mathematics course recently may find that they do not recall all of the material learned previously. Therefore, students whose mathematics placement scores are older than one year are strongly encouraged to retake the appropriate mathematics placement test and review their mathematics skills before enrolling in a math course. Students who have scores for older placement tests should refer to the Mathematics Department website for more information: http://www.math.uiowa.edu/undergraduate-program/math-placement.

There are two different math placement tests available to students. Students should contact their advisors if they are unsure of which exam to take. The initial placement exam that most undergraduates take is called ALEKS; it is available through the UI Evaluation and Evaluation Service. The table below provides the placement scores needed for each course. ALEKS test places the students into courses up to and including Calculus I.

<table>
<thead>
<tr>
<th>Courses</th>
<th>Minimum ALEKS Score</th>
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<tbody>
<tr>
<td>MATH:0100 (22M:001) Basic Algebra I</td>
<td>14%</td>
</tr>
<tr>
<td>MATH:0300 (22M:003) Basic Geometry</td>
<td>35%</td>
</tr>
<tr>
<td>MATH:1005 (22M:008) College Algebra</td>
<td>30%</td>
</tr>
<tr>
<td>MATH:1010 (22M:005) Trigonometry</td>
<td>55%</td>
</tr>
<tr>
<td>MATH:1020 (22M:009) Elementary Functions</td>
<td>60%</td>
</tr>
<tr>
<td>MATH:1120 (22M:006) Logic of Arithmetic</td>
<td>35%</td>
</tr>
<tr>
<td>MATH:1130 (22M:012) Theory of Arithmetic</td>
<td>75%</td>
</tr>
<tr>
<td>MATH:1140 (22M:081) Geometry for Elementary Teachers</td>
<td>35%</td>
</tr>
<tr>
<td>MATH:1240 (22M:010) Finite Mathematics</td>
<td>55%</td>
</tr>
<tr>
<td>MATH:1340 (22M:013) Mathematics for Business</td>
<td>45%</td>
</tr>
<tr>
<td>MATH:1380 (22M:017) Calculus and Matrix Algebra for Business</td>
<td>65%</td>
</tr>
<tr>
<td>MATH:1440 (22M:015) Mathematics for the Biological Sciences</td>
<td>55%</td>
</tr>
<tr>
<td>MATH:1460 (22M:016) Calculus for the Biological Sciences</td>
<td>70%</td>
</tr>
<tr>
<td>MATH:1550 (22M:031) Engineering Math I</td>
<td>75%</td>
</tr>
<tr>
<td>MATH:1850 (22M:025) Calculus I</td>
<td>75%</td>
</tr>
</tbody>
</table>

The MPT3 is intended for students who may be prepared for Calculus II but do not have credit for a college credit course equivalent to Calculus I. The MPT 3 is also administered through the UI Evaluation and Examination Service.

Students are encouraged to retake placement tests if they do not place into the course they want to take. Students who register for an ALEKS mathematics placement test are entitled to 5 placement exams and 6 months of access to an ALEKS learning module.

Students wishing to retake the MPT 3 should send an email with their name and University ID number to Cynthia Farthing (cynthia-farthing@uiowa.edu) to be granted access to retest.
**Dept. of Mathematics**

**MATH:0100 (22M:001)** Basic Algebra I *

**MATH:1005 (22M:008)** College Algebra**

**MATH:1020 (22M:009)** Elementary Functions (Pre-calculus)

**MATH:1010 (22M:005)** Trigonometry**

Also must have 1005 or 1340 before taking Calc. 1380, 1460, 1550, or 1850

**MATH:1240 (22M:010)** Finite Mathematics

**MATH:1340 (22M:013)** Math for Business***

*These two high-school level courses do not count for graduation or QFR

**MATH:1380 (22M:017)***
Calculus & Matrix Algebra for Business

***There is no trigonometry in these two business courses; going to MATH:1460 or 1850 requires ALEKS or MATH:1010

**MATH:1460 (22M:016)** Calculus for Biology

**MATH:1440 (22M:015)** Math for Biology

**MATH:1050 (22M:031)** Engineering Math I: Single Variable Calculus

**MATH:1550 (22M:032)****** Engineering Math II: Multi-Variable Calculus

(See Engineering Dept. for further course information)

**MATH:2700 (22M:027)** Intro to Linear Algebra

Both 1860 & 2700 are required for 3800

**MATH:2850 (22M:028)** Calculus III

2850 must be taken concurrently with or before 3600

**MATH:3600 (22M:100)** Intro to Ordinary Differential Equations

**MATH:3720 (22M:050)** Intro to Abstract Algebra

MATH:3770 (22M:055)
Fundamental Properties of Spaces & Functions I

**MATH:3800 (22M:72)** Elem. Numerical Analysis

Upper-level electives for BA & BS,
See page 37

Students who struggle in 1005 go to 1340; if they do well in 1005 or place with ALEKS, they can go from 1005 to 1380
MATHEMATICS INCENTIVE PROGRAM (MIP)

Students who studied Calculus in high school or elsewhere, but did not receive AP credit, or transfer credit, or any other college credit for a Calculus I should be able to start with Calculus II rather than repeating Calculus I. That is why the MIP was invented. Students who place into Calculus II by the math placement test and receive a grade of at least “B” in the course will automatically receive 4 s.h. credits for Calculus I in addition to the credits earned for Calculus II. There may be some restrictions; please contact College of Liberal Arts and Sciences Academic Programs (120 Schaeffer Hall) who implements this program. Student needs to apply to CLAS Academic Programs, 120 Schaeffer Hall in order to get MIP credit.

MATHEMATICS TUTORIAL LAB

The Mathematics Tutorial Laboratory is a place for students to get assistance studying for their math classes. Its primary function is to provide students with the opportunity to receive one-on-one help from tutors ready and able to answer questions; the Math Tutorial Lab gets about 15,000 student visits each semester. Tutors are math graduate students, and advanced math majors.

Location: 125 MacLean Hall
Phone: (319) 335-0810

Visit http://www.math.uiowa.edu/math-tutorial-lab for more information, as well as http://www.math.uiowa.edu/math-tutorial-lab/other-tutoring-resources for other tutorial services on campus.

Undergraduate math majors who are interested in tutoring in the lab should apply, by sending an e-mail to Cynthia-Farthing@uiowa.edu.
OVERVIEW OF THE BA/BS PROGRAMS IN MATHEMATICS

There are three programs leading to a degree of Bachelor of Arts (BA) or Bachelor of Science (BS). The Department also offers a minor in Mathematics. It is especially easy to earn a double major or major/minor combination in Mathematics with Statistics/Actuarial Science or with Computer Science because many of their courses count toward a Mathematics degree.

A  Program A is the traditional and most general degree. This program is very flexible. One student might take electives specifically preparing for graduate work in mathematics, while another might take courses emphasizing tools for applications, including CS: (Computer Science) and STAT: (Statistics and Actuarial Science) electives.

B  Program B serves the mathematics majors who are preparing for secondary school teaching. This is a carefully designed program enabling students to satisfy the State of Iowa requirements for Secondary Teaching Certification, as well as College of Education and Department of Mathematics requirements. After completing at least 30 semester hours of college credit, including two semesters of calculus (and with satisfactory GPA), a student applies for admission to the Teacher Education Program (TEP) in the College of Education. See page 12 for the other requirements. The student continues to be advised jointly by Mathematics and Education faculty. In addition to mathematics courses, TEP students take specified courses in Education and can select liberal arts General Education courses to meet other State requirements. However, a student may pursue Program B without being admitted to the TEP.

C  Program C is designed for students who want a degree in mathematics with a clear specialization in some area of application. The key is that certain courses in the area of application are counted towards the mathematics degree. (This also facilitates double majors or major/minor combinations.) Students can focus on areas for which standard templates already have been approved: Biomathematics, Biostatistics, Chemistry, Computer Science, Economics, Engineering (each department), Finance, Optimal Business Decision-Making, Physics, Risk Management/Insurance, Statistics and Actuarial Science. Also, the students can propose a plan of study for a new specialization. For a new specialization, a student consults with a Mathematics faculty advisor to prepare a program of studies tailor-made to her/his future plans or career needs. The proposed program of studies must be approved by the Director of the Undergraduate Program and the Mathematics Department Undergraduate Committee.
REQUIREMENTS FOR ALL BA/BS MATH DEGREES

Earning a degree in Mathematics involves meeting the mathematics course requirements in addition to the department’s rules and those of the College of Liberal Arts and Sciences. More information about CLAS regulations can be found in the University of Iowa College Catalog.

The minimum core mathematics course requirements for a B.A. are as follows:

**Program A Required:**
Calculus I & II, MATH:2700, 2850, 3600, 3720, 3770, (22M:027, 028, 100, 050, 055) plus electives.

**Program B Required:**
Calculus I & II, MATH:2150 (22M:070), 2700, 2850, 3720, 3770 (22M:027, 028, 050, 055); 4050 or 4060 (22M:150 or 151); CS:1210 (22C:016); STAT:3120 (22S:120); plus post-calculus and upper-level electives.

**Program C Required:**
Calculus I & II, MATH:2700, 2850, and 3720 or 3770; plus other required courses and/or electives.

For the B.S. in all three programs, two additional courses must be completed; the levels of these courses vary depending on programs and specialties.

In addition to meeting the course requirements, students majoring in Mathematics at the University of Iowa must adhere to the following five rules.

1. **Students majoring in mathematics must satisfy the department’s residency requirement.** Every math major must earn at least 15 semester hours at UI in post-calculus courses offered in Mathematical Sciences, and at least 12 s.h. of them must be offered by (or be cross-listed with) the Mathematics Department. The post-calculus courses in Mathematics are those numbered higher than 2000 but excluding MATH:3700, 3750, 3995-3997, 4010, and 4020 (courses numbered 22M:27 or higher excluding 22M:31, 32, 81, 104, 105, 109, 110 and 196-199). Acceptable post-calculus Computer Science and Statistics courses must have a calculus prerequisite. No transfer courses or credit by examination will be accepted for the post-calculus course residency requirement.

2. **Every math major must take at least one upper-level math course for BA, and at least two upper-level math courses for BS.** Upper-level Math courses are MATH:3900 or courses numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (courses numbered 22M:096 or 22M:113 or higher excluding 22M:196-199). This requirement has been satisfied by the overall requirements of the Programs A and B for long time. For Program C:
   - All students declared a math major in Fall 2012 and after must take at least one upper-level math course for BA or BS in Program C.
   - All students declared a math major in Fall 2016 and after must take at least two upper-level math courses for BS in Program C. BA rule remain the same as above.

3. **All electives satisfying a course requirement must be at least 3 semester hours.** Combining lower semester-hour courses to satisfy one course requirement is not allowed.

4. **All courses used to satisfy major or minor requirements must be chosen to avoid duplication and regression with other math courses.** Students taking Engineering Math courses (MATH:1550, 1560, 2550, 2560, 3550) to satisfy major or minor requirements should pay close attention to duplication rules. See, Appendices A and B, pages 44-49.

5. **A minimum grade point average of 2.00 is required for graduation.** Students must earn an overall GPA of 2.00 as well as a 2.00 minimum within the courses counted for the math major among UI courses, as well as all college courses.
PROGRAM A, BA/BS: MATHEMATICS

This program requires 7 core courses plus a minimum of 4 (BA) or 6 (BS) electives.

Core Courses

Calculus I and Calculus II 8-10 s.h.
Either of the sequences MATH:1550-1560 (22M:031-032, 8 s.h.) or MATH:1850-1860 (22M:025-026, 8-10 s.h.) is acceptable. The sequences are distinct enough that the Department does not encourage students to switch from one version of Calculus I to a different version of Calculus II unless there is a strong need and good preparation. Advanced placement credit, CLEP credit, and credit obtained through the Mathematics Incentive Program is accepted for all or part of the calculus requirement.

MATH:2700 (22M:027) Introduction to Linear Algebra 4 s.h.
MATH:2850 (22M:028) Calculus III 4 s.h.
MATH:3600 (22M:100) Introduction to Ordinary Differential Equations 3 s.h.
MATH:3720 (22M:050) Introduction to Abstract Algebra I 4 s.h.
MATH:3770 (22M:055) Fundamental Properties of Spaces and Functions I 4 s.h.

Higher level courses may be substituted for core courses if approved by the Director of Undergraduate Studies.

Electives

For the B.A. degree, students must take at least four elective courses (each 3-4 s.h.) from the following list, including at least one upper-level mathematics course. Upper-level mathematics courses are MATH:3900 or courses numbered higher than 4000 but excluding MATH:4010, 4020, and 4120 (courses numbered 22M:096 or 22M:113 or higher, excluding 22M:196-199). For the B.S. degree, the requirement is six elective courses from the following list, including at least three that are upper-level math courses.

List of Electives for Program A

1. Mathematics courses MATH: 2150, or 3800 or higher, but excluding 4010, and 4020 (22M:70 or higher, excluding 22M: 081, 095, 100, 104, 105, 109 and 110).
2. Computer Science courses CS:1210 (22C:016) through CS:4740, excluding CS:2111, 3210, 3910, 3980, 3990. The independent study, reading, topics, seminar and project courses are excluded unless approved by the Mathematics Department in advance.
   List: CS: 1210, 2110, 2210, 2230, 2420, 2520, 2620, 2630, 2820, 3330, 3620, 3640, 3820, 4330, 4340, 4350, 4640, and advanced electives: between 3620-4740 except 3910, 3980, and 3990. (22C:16, 19, 21, 22, 31, 60, 80, 82, 84, 86, 111, 112, 118, 131, 135, 169, 188, and advanced electives)
3. Statistics and Actuarial Science courses that count toward an undergraduate major in Statistics or Actuarial Science, excluding independent study, reading, topics, seminar, project, exam preparation courses, unless approved by the Math Department in advance.
   List: STAT:2020 or 3100 or 3120 (22S:39 or 120 or 130) (only one of these can be counted, and only if taken before STAT:4100); Additional accepted courses are: STAT: 3101, 3200, 3210, 3620, 4100, 4101, 4510, 4520, 4740, 5100, 5101, 5120
   ACTS: 3080, 3085, 4130, 4180, 4230, 4280, 4380
      (22S:131, 133, 138, 150, 152, 153, 154, 158, 169, 174, 175, 179, 180, 181, 182, 183, 190, 193, 194)
PROGRAM B, BA/BS: MATHEMATICS FOR SECONDARY EDUCATION

This program is intended for students seeking secondary school teaching licensure. However, students not seeking licensure may complete the program without being admitted to the Teacher Education Program (TEP). To obtain licensure, students complete Mathematics BA/BS requirements and also certification requirements of the State and the College of Education. The information presented here is sufficient for most planning, but students also need to obtain a licensure program guide and a TEP application form from the Office of Education Services, N310 Lindquist Center.

The PRAXIS I exam is required for admission to the TEP. PRAXIS II is currently required for licensure. See a TEP advisor in the Office of Education Services (N310 LC) or go to http://www.education.uiowa.edu/services/educationservices/home for additional information.

There are three sets of requirements for secondary-school certification in mathematics:
1. Admission to the TEP. See to http://www.education.uiowa.edu/services/educationservices/home
2. Mathematics (including some CS and STAT) courses for BA/BS degree
3. College of Education Required Courses

1. Admission to the Teacher Education Programs (TEP)

Admission Procedures

Application forms for admission to the teacher education program may be obtained from the Office of Education Services url http://www.education.uiowa.edu/docs/default-source/oes-docs/tep-app/teacher-education-program-application-for-admission.pdf?sfvrsn=2

The application deadlines are March 15 and October 15. A limited number of applicants are accepted into the mathematics teacher education program, so meeting the minimum requirements listed below does not ensure admission. Other criteria relevant to teaching success are also considered.

Minimum Admission Requirements

1. A University of Iowa GPA and cumulative GPA of 3.0 at the time of admission.
2. Successful completion of at least 30 semester hours of college credit.
3. Successful completion of Calculus I and II with a GPA of 2.5.
4. Successful completion of a 10-hour volunteer practicum in a K-12 classroom setting.
5. Successful completion of the PRAXIS I exam.

A student in the TEP has a TEP advisor as well as a Mathematics advisor. The student should meet with both advisors to plan and monitor progress. See http://www.education.uiowa.edu/services/educationservices for more information.
2. Courses in Mathematics & Mathematical Sciences (11 for B.A., 13 for B.S.)

Candidates for the B.A. degree must take the required eleven courses below.

Calculus I and Calculus II 8-10 s.h.

Either of the sequences MATH:1550-1560 (22M:031-032, 8 s.h.) or MATH:1850-1860 (22M:025-026, 8-10 s.h.) is acceptable. The sequences are distinct enough that the Department does not encourage students to switch from one version of Calculus I to a different version of Calculus II unless there is a strong need and good preparation. Advanced placement credit, CLEP credit, and credit obtained through the Mathematics Incentive Program is accepted for all or part of the calculus requirement.

MATH:2150 (22M:70) Foundations of Geometry 3 s.h.

MATH:2700 (22M:027) Introduction to Linear Algebra 4 s.h.

MATH:2850 (22M:028) Calculus III 4 s.h.

MATH:3720 (22M:50) Introduction to Abstract Algebra I 4 s.h.

MATH:3770 (22M:055) Fundamental Properties of Spaces and Functions I 4 s.h.

MATH:4050 (22M:150) Introduction to Discrete Mathematics OR 3 s.h.

MATH:4060 (22M:151) Discrete Mathematical Models

One additional Mathematics post-calculus course 3-4 s.h.

The post-calculus courses in Mathematics are those numbered higher than 2000 but excluding MATH:3700, 3750, 3995-3997, 4010, and 4020 (courses numbered 22M:27 or higher, excluding 22M:31, 32, 81, 104, 105, 109, 110 and 196-199). Some of these post-calculus courses are not allowable since they may be required above as core courses, or in duplication or regression with some of them, such as Engineering Math courses.

CS:1210 (22C:016) Computer Science I: Fundamentals 4 s.h.

STAT:3120 (22S:120) Probability and Statistics 4 s.h.

The B.S. degree requires at least 2 additional Mathematics courses beyond the 11 courses for the B.A. above. These 2 courses must be numbered MATH:3900, or 4040, or higher. (22M:96, 107, 113 or higher, excluding 22M:196-199).

Some of the B.S.-level CS or STAT courses might be acceptable if it is approved by the Director of the Undergraduate Program.
3. College of Education Required Courses

PSQF:1075  (7P:075) Educational Psychology and Measurement  3 s.h.
This course can be taken before admission to the TEP.

EDTL:3002  (7E:102) Technology in the Classroom  2 s.h.
EDTL:3090  (7S:190) Orientation to Secondary Education  1 s.h.
EDTL:3095  (7S:195) Teaching Reading in Secondary Content Areas  1 s.h.
The above three courses must be taken during the student’s first semester in the College of Education.

EDTL:3000  (7E:100) Foundations of Education  3 s.h.
This course can be taken before admission to the TEP.

EDTL:3071  (7S:171) Secondary Classroom Management  2-3 s.h.
EDTL:4900  (7U:100) Foundations of Special Education  3 s.h.
This course can be taken before admission to the TEP.

EPLS:4180  (7B:180) Human Relations for the Classroom Teacher  3 s.h.
This course may only be waived in N310 LC.
This course can be counted as a CLAS Cultural Diversity General Education requirement.

Methods and Practicum Courses

EDTL:3533  (7S:095) Introduction & Practicum: Mathematics  3 s.h.
This course must be completed prior to EDTL:3534 and EDTL:4535.

EDTL:3534  (7S:134) Methods: Middle School Mathematics  3 s.h.
This course must be completed prior to EDTL:4535.

EDTL:4535  (7S:135) Methods: High School Mathematics  3 s.h.

Student Teaching (final semester)

EDTL:4087  (7S:187) Seminar: Curriculum and Student Teaching  1 s.h.


A checklist of the required math and education courses may be found at the College of Education website: http://www.education.uiowa.edu/docs/default-source/oes-programguides/mathematicsteachereducationprogram512.pdf?sfvrsn=2
Elementary Education Mathematics
Added Endorsement Program K-8

Student Name: UID:

State of Iowa approved preparation program for endorsement number 142, Mathematics K-8, when completed with or following an Elementary Education Teacher Education Program K-6 (endorsement 102). The holder of this endorsement is authorized to teach mathematics from the kindergarten level through grade eight.

Requirements
- Completion of the methods of teaching mathematics courses listed below; and
- Completion of a minimum additional twenty-four semester hours in mathematics to include courses in algebra, geometry, number theory, measurement, computer programming, and probability and statistics.

Methods of Teaching Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Former</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDTL:3163</td>
<td>07E:163</td>
<td>Methods: Elementary School Mathematics</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>EDTL:3534</td>
<td>07S:134</td>
<td>Methods: Middle School Mathematics</td>
<td>3 s.h.</td>
</tr>
</tbody>
</table>

Mathematics (minimum 24 s.h. to include the following)

Number Theory (Complete one of the following or an approved substitution)

| MATH:1130  | 22M:012 | Theory of Arithmetic                              | 3 s.h. |
| MATH:3720  | 22M:050 | Introduction to Abstract Algebra                  | 3 s.h. |

Algebra (Complete one of the following or an approved substitution)

| MATH:1020  | 22M:009 | Elementary Functions                              | 4 s.h. |
| MATH:1240  | 22M:010 | Finite Mathematics                                | 4 s.h. |
| MATH:1340  | 22M:013 | Mathematics for Business                          | 4 s.h. |
| MATH:1440  | 22M:015 | Mathematics for Biological Sciences               | 4 s.h. |
| MATH:2700  | 22M:027 | Introductions to Linear Algebra                   | 4 s.h. |

Geometry (Complete one of the following or an approved substitution)

| MATH:1140  | 22M:081 | Mathematical Basis of Elementary Geometry         | 3 s.h. |
| MATH:2150  | 22M:070 | Foundations of Geometry                            | 3 s.h. |

Complete one of the following or an approved substitution

| MATH:1460  | 22M:016 | Calculus for the Biological Sciences              | 4 s.h. |
| MATH:1380  | 22M:017 | Calculus & Matrix Algebra for Business             | 4 s.h. |
| MATH:1850  | 22M:025 | Calculus I                                        | 4 s.h. |
| MATH:1550  | 22M:031 | Engineering Calculus I: Single Variable Calc.     | 4 s.h. |
### Computer Programming (Complete one of the following or an approved substitution)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS:1020</td>
<td>Computer Literacy</td>
<td>3</td>
</tr>
<tr>
<td>CS:1110</td>
<td>Introductions to Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>CS:1210</td>
<td>Computer Science I: Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>

### Probability and Statistics (Complete one of the following or an approved substitution)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT:1010</td>
<td>Statistics and Society</td>
<td>3</td>
</tr>
<tr>
<td>STAT:1030</td>
<td>Statistics for Business</td>
<td>4</td>
</tr>
<tr>
<td>STAT:1020</td>
<td>Elementary Statistics and Inference</td>
<td>3</td>
</tr>
<tr>
<td>STAT:2020</td>
<td>Prob. &amp; Stats. For Engineer. &amp; Physical Sci.</td>
<td>3</td>
</tr>
<tr>
<td>STAT:4143</td>
<td>Introduction to Statistical Methods</td>
<td>3</td>
</tr>
<tr>
<td>STAT:3120</td>
<td>Probability and Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

### Electives (Complete college-level courses from CS (22C), MATH (22M), or STAT (22S), or approved transfer courses, to reach 24 s.h.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total s.h. (=&gt;24)</td>
<td></td>
</tr>
</tbody>
</table>

### Course Overlap with Mathematics 5-12

The following course options from above also are part of The University of Iowa approved program for endorsement 143 Mathematics grades 5-12:

- CS:1210 Computer Science I: Fundamentals
- MATH:1850 Calculus I
- MATH:2150 Foundations of Geometry
- MATH:2700 Introductions to Linear Algebra
- MATH:3720 Introduction to Abstract Algebra
- STAT:3120 Probability and Statistics

This Program Guide is for planning and documentation of program completion. State requirements for licensure and endorsements are subject to change without notice; check with your adviser or the Office of Education Services for updated requirements. Course transfer and substitution may require syllabi or other documentation in addition to transcript. Revised 2/17/2015 KM/DLT version 2.3.

For additional information, admissions procedures, or advising referral, please contact Office of Education Services, College of Education, N310 Lindquist Center, Iowa City, IA 52242, 319-335-3559, FAX: 319-335-5364, edu-educationservices@uiowa.edu, http://www.education.uiowa.edu
PROGRAM C, B.A./B.S.: MATHEMATICS + SPECIALIZATION

Program C allows students to earn a Mathematics degree (B.A. or B.S.) by combining courses in the Department of Mathematics with courses from one other department. In most areas of specializations, mathematical and/or quantitative courses in other departments are part of the math degree program. All Program C students take a minimum of five core math courses: Calculus I, Calculus II, Calculus III, Introduction to Linear Algebra, and a proof's course, usually either Introduction to Abstract Algebra or Fundamental Properties of Spaces and Functions I.

As of Spring 2014, the pre-approved areas of specialization are as follows: Biomathematics, Biostatistics, Chemistry, Computer Science, Economics, Engineering (each department), Finance, Optimal Business Decision-Making, Physics, Risk Management/Insurance, Statistics and Actuarial Science. All areas of specialization include electives in their plans of study. Some of the specializations have required courses in addition to the five-course mathematics core.

Every student in Program C must file a plan of study before the start of the senior year. In consultation with a mathematics advisor, a student prepares a proposed list of courses. The plan (with the advisor’s endorsement) is then forwarded to the Department’s Director of Undergraduate Studies for approval. If the proposal follows one of the pre-approved established templates, then approval is automatic. If a student and advisor select courses that vary from the established templates or constitute a new area of specialization, the proposed plan of study must receive the approval of the Director of the Undergraduate Program and/or the Mathematics Department Undergraduate Committee. The plans for B.A. courses usually have 11-12 courses, and the plans for B.S. courses usually have 13-14 courses (depending on the specialization).

All Program C course plans must fulfill the following four requirements.

1) Each elective satisfying a course requirement must be at least 3 semester hours. Combining lower semester-hour courses to satisfy one course requirement is not allowed.

2) Every math major must take at least one upper-level math course for BA, and at least two upper-level math courses for B.S.. Upper-level Math courses are MATH:3900 or courses numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (courses numbered 22M:096 or 22M:113 or higher excluding 22M:196-199).
   a) B.A.: All students who declared a math major in Fall 2012 and after must take at least one upper-level math course for B.A..
   b) B.S.: All students who declared a math major in Fall 2016 and after must take at least two upper level math courses for B.S. in Program C. The students who declared a math major in Fall 2012 and after, but before Fall 2016 must take at least one upper-level math course for B.S..

3) Every subtrack has a list of approved electives. If an area of specialization requires additional courses beyond the five core Mathematics courses, these additional courses are counted toward the electives. At least three of the approved electives that students can select must be in the mathematical sciences (Mathematics, Statistics and Actuarial Science, and Computer Science) (MCS) with the following restrictions.
   a) B.A.: At least two of these three MCS courses must have MATH (22M) prefix, and must be post-calculus.
   b) B.S.: All students who declared a math major in Fall 2016 and after must take at least three post-calculus MATH courses including two upper level MATH courses for B.S.. All B.S. students who declared a math major before Fall 2016 are allowed to use the option (3a) regarding the number of the MATH electives.
4) **Students majoring in mathematics must satisfy the department’s residency requirement.**  
Every math major must earn at least 15 semester hours at UI in post-calculus courses offered in Mathematical Sciences, and at least 12 s.h. of them must be offered by (or be cross-listed with) the Mathematics Department. The post-calculus courses in Mathematics (PC) are those with numbers higher than 2000 excluding MATH:3700, 3750, 3995-3997, 4010, and 4020 (courses with numbers 22M:27 or higher excluding 22M:31, 32, 81, 104, 105, 109, 110 and 196-199). Acceptable post-calculus Computer Science and Statistics courses must have a calculus prerequisite. No transfer courses or credit by examination will be accepted for the post-calculus course residency requirement.

**Core Mathematics Courses for Program C**

Calculus I and Calculus II  
Either of the sequences MATH:1550-1560 (22M:031-032, 8 s.h.) or MATH:1850-1860 (22M:025-026, 8-10 s.h.) is acceptable. The sequences are distinct enough that the Department does not encourage students to switch from one version of Calculus I to a different version of Calculus II unless there is a strong need and good preparation. Advanced placement credit, CLEP credit, and credit obtained through the Mathematics Incentive Program is accepted for all or part of the calculus requirement.

- MATH:2700 (22M:027) Introduction to Linear Algebra 4 s.h.
- MATH:2850 (22M:028) Calculus III 4 s.h.
- Either of MATH:3720 (22M:050) Introduction to Abstract Algebra I 4 s.h.
- or MATH:3770 (22M:055) Fundamental Properties of Spaces and Functions I

Higher level courses may be substituted for core courses if approved by the Mathematics Department Director of Undergraduate Studies.

**List of Mathematical Sciences Courses for Program C**

1. Mathematics courses MATH: 3600 or higher, but excluding 3700, 3750, 3995-3997, 4010, 4020, and 4120 (22M:72 or higher excluding 22M:081, 095, 104, 105, 107, 109, 110, 196-199). Independent study, reading, topics, seminar, project courses are not allowed unless approved by the Math Department in advance.

2. Computer Science courses CS:1210 (22C:016) through CS:4740, excluding CS:2111, 3210, 3910, 3980, 3990. The independent study, reading, topics, seminar and project courses are excluded unless approved by the Mathematics Department in advance.

List: CS: 1210, 2110, 2210, 2230, 2420, 2520, 2620, 2630, 2820, 3330, 3620, 3640, 3820, 4330, 4340, 4350, 4640, and advanced electives: between 3620-4740 except 3910, 3980, and 3990. (22C:16, 19, 21, 22, 31, 60, 80, 82, 84, 86, 111, 112, 118, 131, 135, 169, 188, and advanced electives)

3. Statistics and Actuarial Science courses that count toward an undergraduate major in Statistics or Actuarial Science, excluding independent study, reading, topics, seminar, project, exam preparation courses unless approved by the Math Department in advance.

List: Only one of STAT:2020 or 3100 or 3120 (22S:39 or 120 or 130) (only one of these can be counted, and only if taken before STAT:4100);

Additional accepted courses are:

- STAT: 2010, 3101, 3200, 3210, 3620, 4100, 4101, 4510, 4520, 4740, 5100, 5101, 5120
- ACTS: 3080, 3085, 4130, 4180, 4230, 4280, 4380
  (22S:30, 131, 133, 138, 150, 152, 153, 154, 158, 169, 174, 175, 179, 180, 181, 182, 183, 190, 193, 194)
Program C Specialization: Biomathematics (2016)

This program requires 7 courses in Mathematics plus 4 (B.A.) or 6 (B.S.) electives in Mathematics and Biology. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

Required 5 Core Math Courses

- MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
- MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
- MATH:2700 (22M:027) Introduction to Linear Algebra
- MATH:2850 (22M:028) Calculus III
- MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Additional Required Courses

- (PC) MATH:3600 (22M:100) Introduction to Differential Equations
- (U) MATH:4610 (22M:140) Continuous Mathematical Models

Elective Courses

The B.A. requires 4 electives. Select at least 1 elective from Group I, at least 2 electives from Group II, and all from Groups I, II, and III. The plan must include at least 1 (U) upper-level MATH course (such as MATH 4610) and more is recommended.

The B.S. requires 6 electives. Select at least 1 elective from Group I, at least 2 electives from Group II, and all from Groups I, II, and III. There must be at least 3 post-calculus courses in the plan with MATH prefix beyond the 5 core math courses. The plan must include at least 2 (U) upper-level MATH courses (such as MATH 4610, 4060) and more is recommended.

Group I:
- (PC) MATH:3800 (22M:072) Elementary Numerical Analysis
- (MCS) STAT:3120 (22S:120) Probability and Statistics

Group II:
At least two 2000 or higher-level courses in one area of biology, such as ecology and evolutionary biology, genetics, molecular and cellular biology, developmental biology, physiology, pharmacokinetics, neurobiology, immunology, biochemistry epidemiology, microbiology, or biomedical engineering

- BIOL: 2000 or higher-level course from this list
- BIOL: 2000 or higher-level course from this list

Group III:
- (U) MATH:4060 (22M:151) Discrete Mathematical Models
- (U) MATH:4820 (22M:174) Optimization Techniques
- (U) MATH:5600 (22M:142) Nonlinear Dynamics with Numerical Methods
- (U) MATH:5700 (22M:144) Partial Diff. Equations w. Numerical Methods
- (U) MATH:5800 (22M:170) Num. Analysis: Nonlinear Equations
- (U) MATH:5810 (22M:171) Num. Analysis: Differential Equations
- (MCS) CS:1210 (22C:016) Computer Science I: Fundamentals
- BIOL: 2000 or higher-level course in any area of biology
Program C Specialization: Biostatistics (2016)

This program requires 6 courses in Mathematics and BIOL:1141, plus 4 (B.A.) or 6 (B.S.) electives in Mathematics Biology, Statistics, and College of Public Health. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

Required 5 Core Math Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:1850</td>
<td>Calculus I or MATH:1550 (Engineering Math I)</td>
</tr>
<tr>
<td>MATH:1860</td>
<td>Calculus II or MATH:1560 (Engineering Math II)</td>
</tr>
<tr>
<td>MATH:2700</td>
<td>Introduction to Linear Algebra</td>
</tr>
<tr>
<td>MATH:2850</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MATH:3770</td>
<td>Fundamental Properties of Spaces &amp; Functions I</td>
</tr>
</tbody>
</table>

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Additional Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>(PC) MATH:3600</td>
<td>Introduction to Ordinary Differential Equations</td>
</tr>
<tr>
<td>BIOL:1141</td>
<td>Introductory Animal Biology</td>
</tr>
</tbody>
</table>

Elective Courses

4 electives are required for the B.A. and 6 electives are required for the B.S.
Select 2 or more from Group I, and all electives from Groups I and II satisfying:

- **For B.A.:** The plan must have at least 3 post-calculus courses from Mathematical Sciences (MCS) beyond the 5 core math courses. At least 2 of the 3 post-calculus courses must have MATH prefix. The plan must have at least 1 upper-level MATH course.
- **For B.S.:** The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core math courses. The plan must have at least 2 upper-level MATH courses.
- At least 1 elective must be from the College of Public Health (i.e., BIOS, EPID, or OEH).
- The plan must include at least 1 of the following sequences:
  - MATH:3600 & 4610;
  - STAT:4100 & 4101;
  - 2 of these: MATH:3800, 4820, 5800, 5810.

**Group I:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>(PC) MATH:3800</td>
<td>Elementary Numerical Analysis</td>
</tr>
<tr>
<td>(U) MATH:4610</td>
<td>Continuous Mathematical Models</td>
</tr>
<tr>
<td>BIOS:5710</td>
<td>Biostatistical Methods I</td>
</tr>
<tr>
<td>EPID:4400</td>
<td>Epidemiology I: Principles</td>
</tr>
<tr>
<td>OEH:4240</td>
<td>Global Environmental Health</td>
</tr>
</tbody>
</table>

**Group II:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>(U) MATH:4060</td>
<td>Discrete Mathematical Models</td>
</tr>
<tr>
<td>(U) MATH:4820</td>
<td>Optimization Techniques</td>
</tr>
<tr>
<td>(U) MATH:5800</td>
<td>Num. Analysis: Nonlinear Equations</td>
</tr>
<tr>
<td>(U) MATH:5810</td>
<td>Num. Analysis: Differential Equations</td>
</tr>
<tr>
<td>(MCS) STAT:4100</td>
<td>Mathematical Statistics I</td>
</tr>
<tr>
<td>(MCS) STAT:4101</td>
<td>Mathematical Statistics II</td>
</tr>
<tr>
<td>BIOS:7500</td>
<td>Preceptorship in Biostatistics</td>
</tr>
</tbody>
</table>
Program C Specialization: Chemistry (2016)

This program requires 6 courses in Mathematics and CHEM:3250, plus at least 5 (B.A.) or 6 (B.S.) electives in Mathematics and Chemistry. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

**Required 5 Core Math Courses**

- MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
- MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
- MATH:2700 (22M:027) Introduction to Linear Algebra
- MATH:2850 (22M:028) Calculus III
- MATH:3720 (22M:050) Introduction to Abstract Algebra OR MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

**Additional Required Courses**

- (PC) MATH:3600 (22M:100) Introduction to Ordinary Differential Equations
- CHEM:3250 (004:125) Inorganic Chemistry

**Elective Courses**

Only one of MATH:3720 and MATH:3770 can be counted as an elective if both are taken.

**B.A.** requires 5 electives. Select at least 2 electives from Group I and at least 3 electives from Group II. The plan must have at least 3 post-calculus courses from Mathematical Sciences (MCS) beyond the 5 core math courses. At least 2 of the 3 post-calculus courses must have MATH prefix. The plan must have at least 1 upper-level MATH course.

**B.S.** requires 6 electives. Select at least 2 electives from Group I and at least 3 electives from Group II. The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core math courses. The plan must have at least 2 upper-level MATH courses.

**Group I: Math**

- (PC) MATH:3720 (22M:050) Introduction to Abstract Algebra OR (PC) MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I
- (PC) MATH:3800 (22M:072) Elementary Numerical Analysis
- (U) Upper-level MATH courses: MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (22M:096 or 22M:113 or higher excluding 22M:196-199).
- (MCS) One STAT, ACTS or CS (22S or 22C) course from the list on page 19.

**Group II: Chemistry**

- CHEM:3110 (4:111) Analytical Chemistry I
- CHEM:3120 (4:112) Analytical Chemistry II
- CHEM:3430 (4:133) Principles of Physical Chemistry
- CHEM:4431 (4:131) Physical Chemistry I
- CHEM:4432 (4:132) Physical Chemistry II
- CHEM:4480 (4:180) Introduction to Molecular modeling
- CHEM:3994 (4:180) Undergraduate Research (only with prior approval from Math)
- CHEM:5114 Chemical Systems modeling
Program C Specialization: Computer Science (2016)

This program requires 5 core courses in Mathematics plus at least 6 (B.A.) or 8 (B.S.) electives in Mathematics and Computer Science. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). For the Computer Science subtrack, all courses in the plan must have MATH (22M) or CS (22C) prefix. A Program C Plan of Study must be filed before the start of the senior year.

Required 5 Core Math Courses

____ MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
____ MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
____ MATH:2700 (22M:027) Introduction to Linear Algebra
____ MATH:2850 (22M:028) Calculus III
____ MATH:3720 (22M:050) Introduction to Abstract Algebra OR
MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Elective Courses

Only one of MATH:3720 and MATH:3770 can be counted as an elective if both are taken.

B.A. requires 6 electives. Select at least 2 electives from Group I and at least 4 electives from Group II. The plan must have at least 2 post-calculus courses with MATH prefix beyond the 5 core math courses, and must have at least 1 upper-level MATH course.

B.S. requires 8 electives. Select at least 3 electives from Group I and at least 4 electives from Group II. The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core math courses, and must have at least 2 upper-level MATH courses.

Group I: Math

____ (PC) MATH:3600 (22M:100) Introduction to Ordinary Differential Equations
____ (PC) MATH:3720 (22M:050) Introduction to Abstract Algebra
____ (PC) MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I
____ (PC) MATH:3800 (22M:072) Elementary Numerical Analysis
____ (U) Upper-level MATH course(s):

MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (22M:096 or 22M:113 or higher excluding 22M:196-199).

Group II: Computer Science

Computer Science courses CS:1210 (22C:016) through CS:4740, excluding CS:2111, 3210, 3910, 3980, 3990. The independent study, reading, topics, seminar and project courses are excluded unless approved by the Mathematics Department in advance.

List: CS: 1210, 2110, 2210, 2230, 2420, 2520, 2620, 2630, 2820, 3330, 3620, 3640, 3820, 4330, 4340, 4350, 4640, and advanced electives: between 3620-4740 except 3910, 3980, and 3990. (22C:16, 19, 21, 22, 31, 60, 80, 82, 84, 86, 111, 112, 118, 131, 135, 169, 188, and advanced electives)

____ CS course from the list above
____ CS course from the list above
____ CS course from the list above
____ CS course from the list above

Notes: Only a few additional courses are required to earn a double major in Mathematics after completing a major in Computer Science.
Program C Specialization: Economics (2016)

This program has 9 required courses; and in addition, at least 3 (B.A.) or 4 (B.S.) electives are needed from Mathematics and Economics. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

**Required 5 Core Math Courses**

- MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
- MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
- MATH:2700 (22M:027) Introduction to Linear Algebra
- MATH:2850 (22M:028) Calculus III
- MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I (preferred) **OR**
  - MATH:3720 (22M:050) Introduction to Abstract Algebra

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

**Additional Required Courses**

- (MCS) CS:1210 (22C:016) Computer Science I: Fundamentals
- ECON:3100 (06E:104) Intermediate Microeconomics (**prerequisite is ECON:1100**)
- ECON:3150 (06E:105) Intermediate Macroeconomics (**prerequisite is ECON:1200**)
- (MCS) STAT:3120 (22S:120) Probability and Statistics

**Elective Courses**

Only one of MATH:3720 and MATH:3770 can be counted as an elective if both are taken.

**B.A.** requires 3 electives. Select at least 2 electives from Group I and at least 1 ECON elective from Group II. **The plan must have at least 1 upper-level MATH course.**

**B.S.** requires 4 electives. Select at least 3 electives from Group I and at least 1 ECON elective from Group II. **The plan must have at least 2 upper-level MATH courses.**

**Group I: Math**

- (PC) MATH:3600 (22M:100) Introduction to Ordinary Differential Equations
- (PC) MATH:3800 (22M:072) Elementary Numerical Analysis
- (U) MATH:4050 (22M:150) Introduction to Discrete Mathematics
- (U) MATH:4060 (22M:151) Discrete Mathematical Models
- (U) MATH:4250 (22M:181) Introduction to Financial Mathematics
- (U) MATH:4610 (22M:140) Continuous Mathematical Models
- (U) MATH:4820 (22M:174) Optimization Techniques
- (U) MATH:4210 (22M:113) Foundations of Analysis
- (U) MATH:5200 (22M:115) Introduction to Analysis I

**Group II: Economics and Finance**

- ECON:3355 (06E:143) Economic and Business Forecasting
- ECON:4140 (06E:175) Labor Economics
- ECON:4190 (06E:187) Mathematical Economics
- ECON:4200 (06E:188) Game Theory
- ECON:4800 (06E:184) Introduction to Econometrics
- ECON:5200 (06E:204) Macroeconomics I
- FIN:3000 (06F:100) Introductory Financial Management
- FIN:3200 (06F:111) Investment Management

**Notes:** Students who are not admitted to a degree seeking undergraduate program in the Tippie College of Business may request special permission to enroll in restricted courses. Please look at [https://tippie.uiowa.edu/current-students/undergraduates/academics/advising/non-tippie-students](https://tippie.uiowa.edu/current-students/undergraduates/academics/advising/non-tippie-students). The students should contact the department offering the course directly. The students must have a UI GPA ≥2.75 to take upper-level Finance courses. There are additional restrictions on the number of Finance Department credits non-Finance majors can take.
Program C Specialization: Engineering (each department) (2016)

This program requires 6 core math courses, 2-4 electives in Mathematics, plus at least 4 electives from one Engineering Department. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year. Students majoring in the College of Engineering need to be aware that a mathematics degree in the College of Liberal Arts and Sciences requires different General Education courses, including the completion (or equivalent competency) of four semesters of one foreign language.

Required Core Math Courses

<table>
<thead>
<tr>
<th>Option 1: Engineering sequence (16 sh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>______ MATH:1550 (22M:031) Engineering Math I</td>
</tr>
<tr>
<td>______ MATH:1560 (22M:032) Engineering Math II</td>
</tr>
<tr>
<td>______ MATH:2550 (22M:033) Engineering Math II</td>
</tr>
<tr>
<td>______ MATH:2560 (22M:034) Engineering Math IV</td>
</tr>
<tr>
<td>______ MATH:3550 (22M:037) Engineering Math V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option 2: Standard math sequence (16 sh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>______ MATH:1850 (22M:025) Calculus I</td>
</tr>
<tr>
<td>______ MATH:1860 (22M:026) Calculus II</td>
</tr>
<tr>
<td>______ MATH:2700 (22M:027) Introduction to Linear Algebra</td>
</tr>
<tr>
<td>______ MATH:2850 (22M:028) Calculus III</td>
</tr>
</tbody>
</table>

Option 1 and 2 courses may be combined according to the rules of Mathematics Department. Please discuss this with the Director of Undergraduate Program in Mathematics.

Required “proofs” course which must be taken in addition to Option 1 or Option 2

| ______ MATH:3720 (22M:050) Introduction to Abstract Algebra OR           |
| ______ MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I|

Electives

B.A. requires 6 electives. Select at least 2 electives from Group I and at least 4 electives from Group II. There must be at least 1 upper-level MATH course in the plan.

B.S. requires 8 electives. Select at least 3 electives from Group I and at least 4 electives from Group II. There must be at least 2 upper-level MATH courses in the plan.

Group I: Additional MATH Courses:

| ______ Post-calculus MATH course beyond the core courses:                |
| ______ MATH:3600* or higher, but excluding 3700, 3750, 3995-3997, 4010, 4020, and 4120 |
| (22M:72 or higher excluding 22M: 081, 095, 104, 105, 107, 109, 110, 196-199). |
| *Only one of MATH:2560 and 3600 (22M:034 and 100) counts if both are taken.

| ______ (U) Upper-level MATH course(s):                                    |
| ______ MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 |
| (22M:096 or 22M:113 or higher excluding 22M:196-199).                    |

Every upper level course, MATH 3720, and MATH 3770 are post-calculus courses. Only one of MATH:3720 and MATH:3770 can be counted as a post-calculus elective if both are taken. Each course can satisfy only one of the course requirements, and one needs different courses to satisfy each of these requirements.

Group II: Engineering Courses: Go to the next pages.
Group II: Engineering Courses: For both B.A. and B.S., at least 4 junior- or senior-level Engineering courses are required, all from the same Engineering Department of the student’s choice. The following lists contain some recommendations. These courses are chosen to have high math content. Independent study, reading, topics, seminar, lab, and project courses are not allowed unless approved by the Math Department in advance. Proposals containing Engineering courses beyond these lists must be discussed with Mathematics DUS.

Electives for ENGINEERING in PROGRAM C in MATH

Biomedical Engineering
051:182 BME:5200 Biomedical Signal Processing
051:185 BME:5210 Medical Imaging Physics
051:148 BME:5220 Digital Imaging Processing
051:186 BME:5230 Multidimensional Image Processing
051:141 BME:5251 Advanced Biosystems
051:170 BME:5401 Biomaterials & Implant Design
051:167 BME:5430 Biotransport
051:154 BME:5510 Cardiac and Vascular Mechanics
051:155 BME:5520 Cardiovascular Fluid Mechanics
051:150 BME:5610 Musculoskeletal Biomechanics

Chemical & Biochemical Engineering
The lists of electives for this department are not finalized yet. Electives are determined in consultation with the Director of the Undergraduate Program in Mathematics (DUS).

Civil & Environmental Engineering
053:136 CEE:3136 Design of Concrete Structures
053:055 CEE:3155 Principles of Environmental Engineering
053:071 CEE:3371 Principles of Hydraulics and Hydrology
053:030 CEE:3530 Soil Mechanics
053:033 CEE:3533 Principles of Structural Engineering
053:086 CEE:3586 Civil Engineering Materials
053:063 CEE:3763 Principles of Transportation
053:157 CEE:4157 Environmental Engineering Design
053:071 CEE:4370 Flow in Open Channels
053:174 CEE:4374 Water Resource Design
053:112 CEE:4512 Engineering Design Optimization
053:133 CEE:4533 Finite Element I
053:134 CEE:4535 Design of Steel Structures
053:162 CEE:4762 Design of Transportation Systems
053:163 CEE:4763 Traffic engineering
CEE:5000 Level Courses (subject to approval by the Math Department)
The following are already approved:
053:169 CEE:5369 Intermediate fluid mechanics
053:140 CEE:5540 Intermediate mechanics of deformable bodies
Electrical & Computer Engineering

- 055:032 ECE:3320 Intro to Digital Design
- 055:033 ECE:3330 Introduction to Software Design
- 055:035 ECE:3350 Computer Architecture and Organization
- 055:036 ECE:3360 Embedded Systems and Systems Software
- 055:043 ECE:3400 Linear Systems II
- 055:041 ECE:3410 Electronic Circuits
- 055:050 ECE:3500 Communication Systems
- 055:060 ECE:3600 Control Systems
- 055:070 ECE:3700 Electromagnetic Theory
- 055:072 ECE:3720 EE Materials and Devices

ECE:5000 level courses (subject to approval by the Math Department)
The following are already approved:
- 055:130 ECE:5300 Switching Theory
- 055:133 ECE:5330 Graph algorithms and combinatorial optimization
- 055:146 ECE:5460 Digital signal processing
- 055:152 ECE:5520 Intro Information & coding theory
- 055:150 ECE:5500 Communication theory
- 055:160 ECE:5600 Control theory
- 055:170 ECE:5700 Advanced electromagnetics

Mechanical and Industrial Engineering

- 058:40 ME:3040 Thermodynamics II
- 058:45 ME 3045 Heat Transfer
- 058:52 ME 3052 Mechanical Systems
- 058:48 ME 4048 Energy System Design
- 058:55 ME 4055 Mech System Design

ME 4000/5000 level courses (subject to approval by the Math Department)
The following are already approved:
- 058:112 ME:4112 Engineering Design Optimization
- 058:115 ME:4115 Finite element I
- 058:154 ME:5154 Intermediate kinetics & dynamics
- 058:160 ME:5160 Intermediate fluid mechanics

- 056:131 IE:3300 Manufacturing Systems
- 056:134 IE:3350 Process Engineering
- 056:144 IE:3400 Human Factors
- 056:147 IE:3450 Ergonomics
- 056:150 IE:3500 Information Systems Design
- 056:162 IE:3600 Quality Control
- 056:166 IE:3610 Stochastic Modeling
- 056:171 IE:3700 Operations Research
- 056:178 IE:3750 Digital Systems Simulation
- 056:176 IE:3760 Applied Linear Regression (Cross listed STAT:3200)
- 056:172 IE:4172 Big Data Analytics

IE: 5000 Level courses (subject to approval by the Math Department)
Program C Specialization: Finance (2016)

This program has 7 required courses; and in addition, at least 5 (B.A.) or 6 (B.S.) electives are needed from Mathematics and Finance. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

**Required 5 Core Math Courses**
- MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
- MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
- MATH:2700 (22M:027) Introduction to Linear Algebra
- MATH:2850 (22M:028) Calculus III
- MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I OR MATH:3720 (22M:050) Introduction to Abstract Algebra

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

**Additional 2 Required Finance Courses**
- FIN:3000 (06F:100) Introductory Financial Management
- FIN:3200 (06F:111) Investment Management
- OR FIN:3300 (06F:117) Corporate Finance

**Elective Courses**

Only one of MATH:3720 and MATH:3770 can be counted as an elective if both are taken.

One of FIN:3200 and FIN:3300 can be counted as an elective if both are taken.

- B.A. requires 5 electives. Select at least 3 electives from Group I and at least 2 electives from Group II. The plan must have at least 3 post-calculus courses from Mathematical Sciences (MCS) beyond the 5 core math courses. At least 2 of the 3 post-calculus courses must have MATH prefix. The plan must have at least 1 upper-level MATH course.

- B.S. requires 6 electives. Select at least 3 electives from Group I and at least 2 electives from Group II. The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core math courses. The plan must have at least 2 upper-level MATH courses.

**Group I: Math**
- MATH:3600 (22M:100) Introduction to Ordinary Differential Equations (PC)
- MATH:3720 (22M:050) Introduction to Abstract Algebra (PC) OR MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I (PC)
- MATH:3800 (22M:072) Elementary Numerical Analysis (PC)
- MATH:4250 (22M:181) Introduction to Financial Mathematics (U)
- Other Upper-level MATH course(s): MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (22M:096 or 22M:113 or higher excluding 22M:196-199).
- One STAT, ACTS or CS (22S or 22C) course from the list on page 19 (MCS)

**Group II: Accounting and Finance**
- ACCT:3020 (06A:120) Financial Accounting Reporting
- FIN:3200 (06F:111) Investment Management
- OR FIN:3300 (06F:117) Corporate Finance
- FIN:3400 (06F:102) Principles of Risk Management and Insurance
- Any FIN course that can be counted toward the major in the Finance department

**Notes:** Students who are not admitted to a degree seeking undergraduate program in the Tippie College of Business may request special permission to enroll in restricted courses. Please look at [https://tippie.uiowa.edu/current-students/undergraduates/academics/advising/non-tippie-students](https://tippie.uiowa.edu/current-students/undergraduates/academics/advising/non-tippie-students). The students should contact the Finance dept. offering the FIN courses directly. The students must have a UI GPA ≥2.75 to take upper-level Finance courses. There are additional restrictions on the number of Finance Department credits non-Finance majors can take.

This program has 8 required courses; in addition, at least 4 (B.A.) or 5 (B.S.) electives are needed. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

Required 5 Core Math Courses

_____ MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
_____ MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
_____ MATH:2700 (22M:027) Introduction to Linear Algebra
_____ MATH:2850 (22M:028) Calculus III
_____ MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I OR
   MATH:3720 (22M:050) Introduction to Abstract Algebra

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Additional 3 Required Courses

_____ (MCS) CS:1210 (22C:016) Computer Science I: Fundamentals
_____ ECON:3100 (06E:104) Microeconomic Theory (prerequisite is ECON:1100)
_____ (MCS) STAT:3120 (22S:120) Probability and Statistics

Elective Courses

Only one of MATH:3720 and 3770 can be counted as an elective if both are taken.

Both B.A. and B.S.: The plan must have at least 1 MSCI course from Group II.

B.A. requires 4 electives. Select at least 2 electives from Group I and at least 2 electives from

Group II. The plan must have at least 3 post-calculus courses from Mathematical Sciences (MCS)
beyond the 5 core math courses. At least 2 of the 3 post-calculus courses must have MATH prefix. The
plan must have at least 1 upper-level MATH course.

B.S. requires 5 electives. Select at least 3 electives from Group I and at least 2 electives from

Group II. The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core
math courses. The plan must have at least 2 upper-level MATH courses.

Group I: Math

_____ (PC) MATH:3600 (22M:100) Introduction to Ordinary Differential Equations
_____ (PC) MATH:3800 (22M:072) Elementary Numerical Analysis
_____ (U) MATH:4050 (22M:150) Introduction to Discrete Mathematics
_____ (U) MATH:4060 (22M:151) Discrete Mathematical Models
_____ (U) MATH:4250 (22M:181) Introduction to Financial Mathematics
_____ (U) MATH:4610 (22M:140) Continuous Mathematical Models
_____ (U) MATH:4820 (22M:174) Optimization Techniques

Group II: Economics, Finance, and Management

_____ ECON:3120 (06E:105) Macroeconomics (prerequisite is ECON:1200)
_____ FIN:3000 (06F:100) Introductory Financial Management
_____ FIN:3200 (06F:111) Investment Management
_____ MSCI:3025 (06K:127) Decision Support Systems
_____ MSCI:3030 (06K:193) Business Process Analysis
_____ MSCI:3200 (06K:182) Database Management
_____ MSCI:3500 (06K:175) Business Intelligence
_____ MSCI:3800 (06K:178) Optimization & Simulation Modeling

Notes: Students who are not admitted to a degree seeking undergraduate program in the Tippie College of Business may request special permission to enroll in restricted courses. Please look at https://tippie.uiowa.edu/current-students/undergraduates/academics/advising/non-tippie-students. The students should contact the department offering the course directly. The students must have a UI GPA ≥2.75 to take upper-level Finance courses. There are additional restrictions on the number of Finance Department credits non-Finance majors can take.
Program C Specialization: Physics (2016)

This program requires 5 core courses in Mathematics plus at least 6 (B.A.) or 8 (B.S.) electives in Mathematics and Physics. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). For the Physics subtrack, all courses in the plan must have MATH or PHYS or ASTR (22M or 029) prefix. A Program C Plan of Study must be filed before the start of the senior year.

Required 5 Core Math Courses

- **MATH:1850** (22M:025) Calculus I or **MATH:1550** (22M:031) Engineering Math I
- **MATH:1860** (22M:026) Calculus II or **MATH:1560** (22M:032) Engineering Math II
- **MATH:2700** (22M:027) Introduction to Linear Algebra
- **MATH:2850** (22M:028) Calculus III
- **MATH:3770** (22M:055) Fundamental Properties of Spaces & Functions I OR **MATH:3720** (22M:050) Introduction to Abstract Algebra

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Elective Courses

Only one of **MATH:3720** and **MATH:3770** can be counted as an elective if both are taken.

Select at least 6 electives for B.A. and select at least 8 electives for B.S., all from Groups I and II, satisfying the following:

- At least 3 electives from Group I, 2 of which must be in physics, and
- At least 3 electives must be in MATH (22M) including
  - At least 1 MATH upper-level course (U) for B.A.
  - At least 2 MATH upper-level courses (U) for B.S.

Group I: requires three or more courses with at least two in physics

- **PHYS:3710** (029:115) Intermediate Mechanics
- **PHYS:3730** (029:118) Statistical Physics
- **PHYS:3811** (029:129) Electricity and Magnetism I
- **PHYS:3812** (029:130) Electricity and Magnetism II
- **PHYS:3741** (029:140) Introduction to Quantum Mechanics I
- **PHYS:3742** (029:141) Introduction to Quantum Mechanics II
- **(PC) MATH:3600** (22M:100) Introduction to Ordinary Differential Equations
- **(PC) MATH:3800** (22M:072) Elementary Numerical Analysis
- **(U) MATH:4200** (22M:118) Complex Variables

Group II:

- **(U) MATH:4210** (22M:113) Foundations of Analysis
- **(U) MATH:4500** (22M:160) Introduction to Differential Geometry I
- **(U) MATH:5200** (22M:115) Introduction to Analysis I
- **(U) MATH:5210** (22M:116) Introduction to Analysis II
- **(U) MATH:5600** (22M:142) Nonlinear Dynamics with Numerical Methods
-** PHYS or ASTR (029) course numbered 3000 or higher that count toward an undergraduate major in Physics or Astronomy, excluding independent study, reading, topics, seminar, lab and project courses unless approved by the Math Department in advance.
Program C Specialization: Risk Management/Insurance (2016)
This program requires 7 core courses plus at least 5 (B.A.) or 6 (B.S.) electives. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). A Program C Plan of Study must be filed before the start of the senior year.

Required Core Courses

______ MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
______ MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
______ MATH:2700 (22M:027) Introduction to Linear Algebra
______ MATH:2850 (22M:028) Calculus III
______ MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I OR
MATH:3720 (22M:050) Introduction to Abstract Algebra

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Additional Required Courses

______ FIN:3000 (06F:100) Introductory Financial Management
______ FIN:3400 (06F:102) Principles of Risk Management & Insurance

Elective Courses

Only one of MATH:3720 and MATH:3770 can be counted as an elective if both are taken.

B.A. requires 5 electives. Select at least 3 electives from Group I; and select at least 2 electives from Group II. The plan must have at least 3 post-calculus courses from Mathematical Sciences (MCS) beyond the 5 core math courses. At least 2 of the 3 post-calculus courses must have MATH prefix. The plan must have at least 1 upper-level MATH course.

B.S. requires 6 electives. Select at least 3 electives from Group I; and select at least 2 electives from Group II, and all from Groups I-III. The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core math courses. The plan must have at least 2 upper-level MATH courses.

Group I: Math

(UC) MATH:3600 (22M:100) Introduction to Ordinary Differential Equations
(UC) MATH:3720 (22M:050) Introduction to Abstract Algebra OR
(UC) MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I
(UC) MATH:3800 (22M:072) Elementary Numerical Analysis
(UC) MATH:4250 (22M:181) Introduction to Financial Mathematics
(UC) Other Upper-level MATH course(s), MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (22M:096 or 22M:113 or higher excluding 22M:196-199).

Group II: Finance

FIN:4420 (06F:103) Property and Liability Insurance
FIN:4430 (06F:105) Life and Health Insurance
FIN:4440 (06F:106) Employee Benefit Plans
FIN:4450 (06F:107) Risk Modeling (restricted to Finance majors or RMI Certificate candidates)

Group III: Accounting, Actuarial Science, Finance, and Marketing

ACCT:3020 (06A:120) Financial Accounting and Reporting
ACCTS:3080 (22S:180) Mathematics of Finance
FIN:3200 (06F:111) Investment Management
FIN:3300 (06F:117) Corporate Finance
FIN:4210 (06F:116) Futures and Options
FIN:4220 (06F:113) Fixed Income Securities
FIN:4230 (06F:126) Real Estate Process
FIN:4320 (06F:114) Commercial Banking
FIN:4410 (06F:104) Corp & Finan Risk Mngt (restricted to Finance majors or RMI Certificate candidates)
MKTG:4200 (06M:139) Sales Management

Notes: Students who are not admitted to a degree seeking undergraduate program in the Tippie College of Business may request special permission to enroll in restricted courses. Please look at https://tippie.uiowa.edu/current-students/undergraduates/academics/advising/non-tippie-students. The students should contact the Finance department offering the FIN courses directly. The students must have a UI GPA ≥2.75 to take upper-level Finance courses. There are additional restrictions on the number of Finance Dept. credits non-Finance majors can take.
Program C Specialization: Statistics and Actuarial Science (2016)

This program requires 5 core courses in Mathematics plus at least 6 (B.A.) or 8 (B.S.) electives in Mathematics and Statistics and Actuarial Science. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 17, 18). For the Statistics and Actuarial Science subtrack, all courses in the plan must have MATH or STAT or ACTS (22M or 22S) prefix. A Program C Plan of Study must be filed before the start of the senior year.

Required 5 Core Math Courses

- MATH:1850 (22M:025) Calculus I or MATH:1550 (22M:031) Engineering Math I
- MATH:1860 (22M:026) Calculus II or MATH:1560 (22M:032) Engineering Math II
- MATH:2700 (22M:027) Introduction to Linear Algebra
- MATH:2850 (22M:028) Calculus III
- MATH:3720 (22M:050) Introduction to Abstract Algebra OR MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I

For any of the above core courses, higher-level Mathematics courses or Engineering math courses may be substituted, if they are approved by the Director of the Undergraduate Program.

Note that MATH:3770 is required for the B.S. in Actuarial Science.

Elective Courses

Only one of MATH:3720 and MATH:3770 can be counted as an elective if both are taken.

**B.A.** requires 6 electives. Select at least 2 electives from Group I and at least 4 electives from Group II. The plan must have at least 2 post-calculus courses with MATH prefix beyond the 5 core math courses, and must have at least 1 upper-level MATH course.

**B.S.** requires 8 electives. Select at least 3 electives from Group I and at least 4 electives from Group II. The plan must have at least 3 post-calculus courses with MATH prefix beyond the 5 core math courses, and must have at least 2 upper-level MATH courses.

**Group I: Math**

- (PC) MATH:3600 (22M:100) Introduction to Ordinary Differential Equations
- (PC) MATH:3720 (22M:050) Introduction to Abstract Algebra OR MATH:3770 (22M:055) Fundamental Properties of Spaces & Functions I
- (PC) MATH:3800 (22M:072) Elementary Numerical Analysis
- (U) Upper-level MATH course(s):
  - MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 (22M:096 or 22M:113 or higher excluding 22M:196-199).

**Group II: Statistics and Actuarial Science** courses that count toward an undergraduate major in Statistics or Actuarial Science, excluding independent study, reading, topics, seminar, project, exam preparation courses unless approved by the Math Department in advance.

**List:** Only one of STAT:2020 or 3100 or 3120 (22S:39 or 120 or 130) (only one of these can be counted, and only if taken before STAT:4100); Additional accepted courses are:
- STAT: 2010, 3101, 3200, 3210, 3620, 4100, 4101, 4510, 4520, 4740, 5100, 5101, 5120
- ACTS: 3080, 3085, 4130, 4180, 4230, 4280, 4380 (22S:30, 131, 133, 138, 150, 152, 153, 154, 158, 169, 174, 175, 179, 180, 181, 182, 183, 190, 193, 194)
- STAT or ACTS course from the list above
- STAT or ACTS course from the list above
- STAT or ACTS course from the list above
- STAT or ACTS course from the list above

**Notes:** Only a few additional courses are required to earn a double major in Mathematics after completing a major in Statistics or Actuarial Science.
DEPARTMENT OF MATHEMATICS

Program C Plan of Study

1. Consult with your advisor or Math DUS (Department of Mathematics Undergraduate Director) to agree on the list of courses you want to apply to your B.A./B.S. in Mathematics Program C. After you and your advisor agree on the list of Courses:
2. Complete this form.
3. Obtain your math advisor's signature. This form also requires a Departmental Approval by DUS before it is finalized.
4. Give the form to Chris Brenneman, Mathematics Secretary, in Room 14 MLH or make an appointment with DUS for a direct approval (preferred method, it saves you time).
5. If Program C isn't on your Degree Evaluation (found on ISIS) in a week, then please contact the DUS.

To: Department of Mathematics
Date: _________________
From: (student's name) ______________________________ ID number: ________________
E-mail: ____________________________

I request approval of the following core courses and electives to satisfy the requirements for a B.A. B.S. in Mathematics Program C, Math + ________________________________ . [circle one] [specialization]

<table>
<thead>
<tr>
<th>CORE COURSES</th>
<th>ELECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Number</td>
<td>Course Name</td>
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</tbody>
</table>

PLEASE SEE OTHER SIDE FOR NECESSARY APPROVALS
ADVISOR: If this plan of study fits one of the templates in the Undergraduate Handbook, simply sign below to indicate your endorsement.

However, if the plan involves a modification of one of the pre-approved templates or an entirely new program, please indicate here your reasons for approving the new plan. Your comments will be used to guide the Undergraduate Committee in understanding your view of the plan.

Math Advisor Signature _________________________________          Date: _______________

Comments: ___________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Department Approval: _______________________________________ (signature)

Date: _________________________

Photocopied and sent to Registrar on _________________(date).
HONORS IN MATHEMATICS

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 GPA 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.

- **MATH:4090 (22M:114)** A Rigorous Introduction to Abstract Algebra  
  4 s.h.
- **MATH:4210 (22M:113)** Foundations of Analysis  
  4 s.h.
- **MATH:5000 (22M:120)** & **MATH:5010 (22M:121)** Abstract Algebra I-II  
  8 s.h.
- **MATH:5200 (22M:115)** & **MATH:5210 (22M:116)** Introduction to Analysis I-II  
  8 s.h.
- **MATH:5400 (22M:132)** & **MATH:5410 (22M:133)** General Topology - Introduction to Smooth Manifolds  
  8 s.h.
- **MATH:5600 (22M:142)** & **MATH:5700 (22M:144)** Nonlinear Dynamics with Numerical Methods - Partial Differential Equations with Numerical Methods  
  8 s.h.
  8 s.h.

Mathematics courses (prefix MATH) numbered 6000 or above, approved by the honors advisor

Option 2: complete an honors project comparable to taking several of the courses above, approved by the honors advisor and the thesis supervisor. Students who choose this option typically register for **MATH:3996 (22M:197)** 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.

In addition to honors in their majors, undergraduate students have a variety of opportunities for honors study and activities through membership in the University of Iowa Honors Program; visit [Honors at Iowa](http://www.honors.iastate.edu) to learn about the University's honors program.
MINOR IN MATHEMATICS

The minor in mathematics requires a minimum of 15 s.h. of credit earned in mathematics courses with the following restrictions:

- At least 12 of the 15 s.h. must be post-calculus MATH courses (with prefix MATH) offered by the Department of Mathematics or an equivalent transfer course. The post-calculus courses in Mathematics are those MATH courses numbered higher than 2000 but excluding MATH:3700, 3750, 3995-3997, 4010, and 4020 (courses numbered 22M:27 or higher excluding 22M:31, 32, 81, 104, 105, 109, 110 and 196-199). Credit by examination does not count toward the 12 s.h. requirement.
- At least 9 of the 12 s.h. in post-calculus math courses must be taken at the University of Iowa. No more than one transfer course can be counted toward the post-calculus requirement.
- Course work in the minor may not be taken pass/nonpass.
- Students must maintain a g.p.a. of at least 2.00 in all courses for the minor and in all UI courses for the minor.
- No courses from other departments are accepted toward the math minor unless the course is cross-listed with a MATH prefix.
- The post-calculus courses must be chosen to avoid duplication and regression with the core math courses, especially when the Engineering Math courses are considered.

Special Rules for Engineering Math Courses

Students who have taken the Engineering calculus sequence of MATH:1560, 2550, 2560, and 3550 (22M:32, 33, 34, and 37) may satisfy the minor requirements by taking one additional 3 or 4 s.h. course with the following restrictions.

- The additional 3 or 4 s.h. MATH course must be numbered MATH:2150 or MATH:3720 or higher, except MATH:3750, 3995-3997, 4010, and 4020 (courses numbered 22M:50 or higher excluding 22M: 81, 100, 104, 105, 109, 110 and 196-199).
- At least four of the five courses MATH:1560, 2550, 2560, 3550 and the additional course (of the previous line) must be taken at the University of Iowa. No more than one transfer course can be counted toward the post-calculus requirement.
- The total number of credits earned through MATH courses must be at least 15.
- Course work in the minor may not be taken pass/nonpass.
- Students must maintain a g.p.a. of at least 2.00 in all courses for the minor and in all UI courses for the minor.
- No courses from other departments are accepted toward the math minor unless the course is cross-listed with a MATH prefix.
- The post-calculus courses must be chosen to avoid duplication and regression with the core math courses and the Engineering Math courses.
SCHEDULE of COURSE OFFERINGS,  
POST-CALCULUS, UPPER LEVEL, and MATH HONORS

Like all academic departments, Mathematics determines its course schedule for each individual semester based on predicted need, funding, faculty availability, and classroom considerations. Therefore the timing and frequency for some courses are not rigidly fixed. The table below includes some of the most commonly taken courses and the standard semesters in which they are usually offered. PC indicates post-calculus, U indicates upper level.

<table>
<thead>
<tr>
<th>Course Number &amp; Title</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:0100 (22M:001) Basic Algebra I *</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:0300 (22M:003) Basic Geometry *</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1000 (22M:014) First Year Seminar</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>MATH:1005 (22M:008) College Algebra</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1010 (22M:005) Trigonometry</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>MATH:1020 (22M:009) Elementary Functions *</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1120 (22M:006) Logic of Arithmetic</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>MATH:1130 (22M:012) Theory of Arithmetic</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH:1140 (22M:081) Geometry for Elementary Teachers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1240 (22M:010) Finite Mathematics</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH:1340 (22M:013) Mathematics for Business</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1380 (22M:017) Calc. &amp; Matrix Algebra for Business</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1440 (22M:015) Math for the Biological Sciences</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1460 (22M:016) Calculus for the Biol. Sciences</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1560 (22M:032) Eng. Math II: Multi-Variable Calculus</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1850 (22M:025) Calculus I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:1860 (22M:026) Calculus II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:2150 (22M:070) Foundations of Geometry</td>
<td>PC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:2700 (22M:027) Introduction to Linear Algebra *</td>
<td>PC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:2850 (22M:028) Calculus III</td>
<td>PC</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>MATH:2995 (22M:095) Introduction to Research Opportunities</td>
<td>PC</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>MATH:3600 (22M:100) Intro. to Ordinary Diff. Equations</td>
<td>PC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:3720 (22M:050) Introduction to Abstract Algebra *</td>
<td>PC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:3770 (22M:055) Fund. Props. Spaces &amp; Functions I</td>
<td>PC</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>MATH:3800 (22M:072) Elementary Numerical Analysis</td>
<td>PC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MATH:4120 (22M:107) History of Mathematics *</td>
<td>PC</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*These courses may also be available as Guided Independent Study (GIS) offerings.

NOTE: MATH: 3700, 3750, 4010, and 4020 require graduate standing, and duplicate some undergraduate courses. Hence, they are not open to undergraduate students. MATH:3995-3997 are not listed, since they have variable topics and some are individual studies with instructors. None of these 7 courses are considered post-calculus or upper level for undergraduates.
Many upper-level courses numbered 3900, 4000-4900 are offered only once per year. PC indicates post-calculus, U indicates upper level, and H indicates eligible for Math Honors. Check ISIS for the alternate prerequisites using Engineering Math courses in the tables below.

<table>
<thead>
<tr>
<th>Course Number &amp; Title</th>
<th>Fall</th>
<th>Spring</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 3900 (22M:96) Introduction to Math Research</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:1860 &amp; 2700</td>
</tr>
<tr>
<td>MATH:4040 (22M:127) Matrix Theory</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2700</td>
</tr>
<tr>
<td>MATH:4050 (22M:150) Introduction to Discrete Mathematics</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:1860 &amp; 2700</td>
</tr>
<tr>
<td>MATH:4060 (22M:151) Discrete Mathematical Models</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2700</td>
</tr>
<tr>
<td>MATH:4090 (22M:114) A Rigorous Intro. to Abstract Algebra</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:3720</td>
</tr>
<tr>
<td>MATH:4200 (22M:118) Complex Variables</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2850</td>
</tr>
<tr>
<td>MATH:4210 (22M:113) Foundations of Analysis</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:3770</td>
</tr>
<tr>
<td>MATH:4250 (22M:181) Introduction to Financial Mathematics</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2850 or STAT:3120</td>
</tr>
<tr>
<td>MATH:4500 (22M:160) Intro. to Differential Geometry I</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2850 &amp; 2700</td>
</tr>
<tr>
<td>MATH:4510 (22M:161) Intro. to Differential Geometry II</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:4500</td>
</tr>
<tr>
<td>MATH:4610 (22M:140) Continuous Mathematical Models</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:3600</td>
</tr>
<tr>
<td>MATH:4740 Large Data Analysis</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2700, CS:1210 &amp; STAT:2010 or 2020</td>
</tr>
<tr>
<td>MATH:4820 (22M:174) Optimization techniques</td>
<td>PC, U</td>
<td>✓</td>
<td>MATH:2700, 2850 &amp; 3800</td>
</tr>
</tbody>
</table>

All first year math graduate courses are open to advanced undergraduates. Please make sure to talk to your advisor and the instructor before you register for these courses.

<table>
<thead>
<tr>
<th>Course Number &amp; Title</th>
<th>Fall</th>
<th>Spring</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:5000 (22M:120) Abstract Algebra I</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:3720 or 4090</td>
</tr>
<tr>
<td>MATH:5010 (22M:121) Abstract Algebra II</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:5000</td>
</tr>
<tr>
<td>MATH:5200 (22M:115) Introduction to Analysis I</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:3770 or 4210</td>
</tr>
<tr>
<td>MATH:5210 (22M:116) Introduction to Analysis II</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:5200</td>
</tr>
<tr>
<td>MATH:5400 (22M:132) General Topology</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:3770 or 4210</td>
</tr>
<tr>
<td>MATH:5410 (22M:133) Introduction to Smooth Manifolds</td>
<td>PC, U, H</td>
<td>✓</td>
<td>MATH:2700, 2850 &amp; 5400</td>
</tr>
</tbody>
</table>

This is not a complete list of MATH courses, the courses MATH:5900 or higher are not included, since they are primarily for graduate students.
DEGREE PLANNING

ADVISING IN MATHEMATICS

All University of Iowa advisors are committed to students’ personal and intellectual growth; that includes helping students make timely progress toward graduation. While students are ultimately responsible for their own successes, advisors serve as student advocates who actively guide and engage students in their course planning and academic decision-making. Advisors can help students best when the students explain their academic and personal challenges, then participate actively in the solutions.

As is true with almost every major on campus, freshmen are advised at the Academic Advising Center (PC210). Each student who has declared an interest in any of the three programs of study is assigned to an advisor who specializes in mathematics. The student and advisor meet several times in the first year; the advisor assists with planning course schedules, understanding degree audits, finding campus and community resources, and familiarizing the student with traditions and academic policies at the University.

Once a declared Math major has earned at least 24 semester hours, the student is assigned to the professional advisor for the Mathematics Department. The department’s advisor continues the assistance that was provided by the AAC and helps students refine their interests in mathematics. The advisor is also available to help students improve their grades by identifying academic resources, exploring individual strategies for learning, and explaining complex academic policies and procedures. The advisor’s contact information is available on the Math Department website (http://www.math.uiowa.edu/people); students can schedule appointments with the advisor from their ISIS accounts.

All sophomore Mathematics majors need the advisor’s signature to register for classes; a signature is also needed when students want to add and/or drop classes. Many sophomores also seek an advisor when they want to discuss changing programs of study, deciding upon a Bachelor of Arts or a Bachelor of Science degree, or looking at additional minor degrees or certificate programs.

When students become juniors – earning 60 or more credit hours – they are usually assigned to a faculty advisor. (Math majors in the Teacher Education Program also have an advisor in the College of Education.) The faculty advisor offers assistance with course scheduling and provides signatures for adding/dropping classes. Although all mathematics majors can continue to contact the professional advisor for general assistance, faculty advisors are the ideal resources for job references and information about careers in mathematics, future graduate study, internships, and research opportunities.
GRADUATING WITH A MATH DEGREE

SAMPLE SCHEDULES are attached at the end of this handbook.

A college degree in mathematics has long been accepted as an admirable accomplishment. Like most majors, it requires good preparation for the academic demands of university courses and a disciplined approach to learning material that continually builds upon a foundation of knowledge. As noted earlier in the handbook (page 9), the University of Iowa offers three different approaches to its Bachelor of Arts (B.A.) and Bachelor of Science (B.S.) degrees in mathematics: math (Program A), math plus education courses for teachers (Program B), and math plus other math-related disciplines (Program C).

Course planning for all three programs begins with a basic understanding of the math courses offered and their prerequisite structures. For that information, refer to the Course Sequence Diagram (page 7). Well-prepared freshmen typically begin in Calculus I or, if they took that class during their high-school years, then Calculus II. Some students do not find their interest in mathematics until later; based on placement testing, they may begin in the pre-calculus course or college algebra.

The Department of Mathematics offers sample schedules for students who come to the University of Iowa knowing that they want to major in math (starting on page 57). These schedules are not rigid templates that must be precisely followed. Rather, they simply demonstrate the range and sequence of coursework required if a student wants to complete a degree within four years. For example, most students attend one or more summer semesters, which are not included on the sample schedules. The schedules suggest possible general education courses for each semester or note the possibility of acquiring a second major or minor degree. Students, in collaboration with their academic advisors, need to plan their own paths to graduation – paths which address individual interests as well as university requirements.

The First Year
Most freshmen who declare math majors take Calculus I and II in their first two semesters. Since Calculus I is the pre-requisite for Linear Algebra, many students take that course in their second (in Program A) or third semester.

The Second Year and Beyond
Another required course for math B.A. and B.S. degrees is Calculus III, usually taken during a student’s second year. Math degrees also require at least one additional course, often referred to as a ‘proofs’ course. These are titled Introduction to Abstract Algebra and Fundamental Properties of Spaces and Functions. One or both of these courses are typically taken in the second year. These five courses – Calculus I, II, III, Linear Algebra and a proofs class – serve as the foundation for further math study in Programs A, B, and C.

Most math majors – especially those pursuing a Bachelor of Science degree – find that they need to enroll in at least two math courses each semester in order to complete their degree requirements. Students in all three programs can use the Schedule of Course Offerings (page 36, 37) to make planning easier. The Schedule provides information not only about when courses are offered but also identify which courses are considered post-calculus and/or upper-level
courses. Math requires students to complete courses that are sufficiently sophisticated and advanced in order to earn the degree.

Special Considerations for Program B

Students wanting to become high school math teachers in Iowa will declare Mathematics Program B as their major. They usually apply for admission to the Teacher Education Program (TEP) in their sophomore. Applications to TEP are accepted in the Fall (October) or Spring (March). Prior to TEP acceptance, there are only a few education courses that can be taken. Program B students must plan to be off campus for student teaching in their final semester, and so schedules before that semester will need to be quite full. Many students acknowledge that getting the teaching degree may take more than the minimum of four years; they plan their time and finances accordingly.

It is also possible for students to earn a Bachelor’s degree in Mathematics Program B without being accepted into the College of Education and TEP. Those students may plan to seek their teaching certification in a different state with different education courses.

Special Considerations for Program C

Because Program C includes courses from other disciplines, it is preferable to declare the major and the specialization in the sophomore year. Students need to work closely with their advisors throughout their college semesters in order to ensure that the correct courses are taken. By the end of the junior year or the beginning of the senior year, Program C math majors are required to file a formal Plan of Study with the Department of Mathematics. Without the Plan of Study, the degree audit cannot indicate which courses are missing, and the students who wait too long to file a plan of study may find out about a missing course very late in their senior year. Most of the upper level courses are offered once a year, and many of the post calculus courses are usually not offered in the summers. The Plan of Study must be reviewed, accepted, and posted in the degree audit before the student can apply to graduate. Do not wait to file your Plan of Study until the degree application, if you do not want a bad surprise.

Graduate School in Mathematics

Students who are considering graduate coursework in mathematics should pursue the B.S. in Program A. They will want to make sure that they have completed several upper-level math classes by the end of their junior year so that they can confidently apply to graduate schools in the fall of their senior year. It is also recommended that these students take a couple of advanced math courses (MATH:5000 or higher) during their senior year. Good grades in math courses are critical for students who want to be accepted as graduate students, either here at UI or at another institution.

Graduate school applications typically include faculty letters of recommendation. In addition to learning course material from math professors, students should get to know their interests and areas of specialization. That is how undergraduates can learn about opportunities to participate in professors’ research. Doing so not only makes it easier for faculty to write a positive, specific letter of recommendation: it can also help students define their focus for graduate study.
PREPARING FOR A JOB OR GRADUATE SCHOOL

Employment prospects are excellent for students who major in mathematics; good starting salaries are typically offered. The UI Department of Mathematics surveyed recent graduates from the department, and found that nearly every student contacted is working in an area where mathematics is used, is teaching mathematics, or is in a graduate program. There are opportunities in all areas, and the national shortage of mathematic teachers in particular makes a math degree very valuable.

Students who are exceptionally good in mathematics can afford to be narrowly specialized. But for most undergraduate students, breadth is an important companion to strength. In addition to building mathematical knowledge and abilities, work on becoming an excellent writer and effective speaker. Develop several interests: for someone seeking a job, that probably means taking courses in some other area(s) that are appealing, especially those where mathematics is used. For someone aiming at graduate school in mathematics, that means taking (and doing well in) some senior/masters level courses.

For all future directions, the following are important:

- Faculty recommendations
- A transcript depicting a good program with respectable grades
- The ability to communicate, both spoken and written
- Exam scores, if relevant for graduate work or professional schools

If at all possible, get to know the faculty members teaching the math courses. Most faculty members welcome genuine interest and are quite willing to discuss students’ academic situations. The UI professors are expected to be accomplished and active scholars. They went into mathematics for the same reasons students do – they liked it and they are good at it – so they are bound to respond well to similar interests. An important bonus is that getting better acquainted with faculty members will make it easier for them to write informed and individualized letters of recommendation when they are needed.

It is also important to develop your communication skills. Math majors will almost certainly be using mathematics in a research team, teaching, or selling position, and your fitness for employment or graduate school will be partly evaluated through an interview or essay.

But who does hire mathematics majors, and what are they doing in those jobs? Some answers are obvious, such as high school or (with advanced degrees) college teaching. Insurance companies hire math majors (as well as Statistics/Actuarial Science majors) for jobs in actuarial analysis. Math majors work in the computer industry. Government agencies such as the Commerce Department, Agriculture Department and National Security Agency hire mathematicians, the first two for data analysis, the latter for theoretical cryptography research. Investment firms hire math majors to analyze trends and optimize portfolios. Airlines hire math majors to analyze routing and scheduling. Large consulting companies welcome mathematics as one of several good preparations. A corporation may welcome a math major to a job that doesn’t really involve mathematics, but just because that person has demonstrated the ability to understand complicated situations and solve problems. The UI Career Center and the Career Fairs it sponsors provide excellent resources for students. Also, check out the AMS website at www.ams.org/employment and search for Early Career Profiles to see which types of jobs recent math majors found. Similarly, check www.maa.org/careers. There are many other types of job-related information on these web pages.
FINANCIAL AND PERSONAL DEVELOPMENT

There are many opportunities for students to enhance their education and perhaps earn extra money while studying math. These include internships, study abroad, assisting faculty in research projects, summer institutes, and scholarships. There are several ways to get information about the availability of such programs:

- Check the bulletin boards in MLH. Many announcements are posted on the Math Department Bulletin boards in the hallway of the first floor or ground floor of MacLean Hall. Watch particularly the space at the left-hand end of the longer board on the first floor. There is an annual competition for a small scholarship in the Mathematics Department and greater opportunities College-wide.
- Check the departmental web site for lists of opportunities for Mathematics students. (Go to Degree Programs and then to Undergraduate Major’s Page.)
- Become a member of SUMS, the Math Club; the newsletter may announce opportunities, and you will learn more from other students.
- Check the financial aid office, the graduate programs offices, or the Career Center (100 Pomerantz Center, Suite C310).
- Check UI email regularly: The Math Department frequently uses that method to communicate with majors.
- Check the AMS websites: www.ams.org/careers-edu/internships.html or www.ams.org/careers-edu/undergrad.html/#jobs

UNDERGRADUATE RESEARCH ASSISTANTSHIPS

The Department (or individual professors with NSF or similar grants) provides stipends to several undergraduates each semester to work with professors on their research as long as funds are available. The work might be supportive (e.g. helping compile a bibliography), pedagogical (e.g. helping develop innovative classroom materials), or doing basic research (e.g. computer experiments or proving theorems). The ideal situation consists of a student and professor who have gotten to know each other and jointly request support for the project, but a sponsor is not required prior to applying. The application form is available from the Department secretary; or online at http://www.math.uiowa.edu/undergraduate-program/undergraduate-research-assistantships. The best time to apply is before the beginning of Fall and Spring semesters.

ICRU is another source for paying URAs. http://www.uiowa.edu/icru/ However, the faculty member applies to these funds in advance, specifying the students, and it is competitive. Students who are working with a math faculty member on an ongoing project may be asked to be a part of such a project.
SUMMER RESEARCH

Each year, a number of colleges around the country have summer REU programs (Research Experience for Undergraduates). The REU announcements are available online (www.ams.org/employment/reu.html).

ICRU is another source for paying URAs for the summers. http://www.uiowa.edu/icru/
However, the faculty member applies to these funds in advance, specifying the students, and it is competitive. Students who are working with a math faculty member on an ongoing project may be asked to be a part of such a project.

In addition to the REU programs, some math faculty members have their own grants that enable them to support an undergraduate student for summer research. Students who are interested in a particular professor’s field of study can ask about participating in their research; students who are interested in a research opportunity but do not have a particular topic or professor in mind can ask the department to help them make a contact.

THE MATH CLUB

The Department of Mathematics sponsors the UI Math Club for undergraduates. Its goal is “to promote the appreciation and enjoyment of math in a casual atmosphere.” The club meets twice per month in order to provide both academic and social activities. It sponsors local math competitions and provides opportunities for regional and national competitions as well. There are occasions to meet other math majors and enjoy events such as guest lectures and films. The club elects officers from among the undergraduate members; those office holders then gain valuable leadership experience related to their career/major interests. For more information, visit the club’s page on the department’s website: http://www.math.uiowa.edu/undergraduate-program/university-iowa-math-club

AMERICAN MATHEMATICAL SOCIETY (AMS)

The American Mathematical Society has an undergraduate math majors’ web page at www.ams.org/employment/undergrad.html This page offers links to information about summer programs, semester programs, math competitions, careers, internships, jobs, and graduate school in mathematics.
### APPENDIX A: REGRESSION AND DUPLICATION TABLE

The general assumption is that a lower-numbered undergraduate course taken after a higher-numbered course constitutes regression. Those circumstances and any exceptions are noted below. For information about courses numbered above 3550, contact your academic advisor or the Director of Undergraduate Studies.

<table>
<thead>
<tr>
<th>4-digit course number</th>
<th>3-digit course number</th>
<th>Course Title</th>
<th>Regression charged if student previously completed</th>
<th>Duplication charged if student previously completed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:0100</td>
<td>22M:001</td>
<td>Basic Algebra I</td>
<td>MATH:1005 or higher</td>
<td>MATH:0100</td>
<td>See Special Consideration 0.</td>
</tr>
<tr>
<td>MATH:0300</td>
<td>22M:003</td>
<td>Basic Geometry</td>
<td>MATH:1005 or higher</td>
<td>MATH:0300</td>
<td>See Special Consideration 0.</td>
</tr>
<tr>
<td>MATH:1000</td>
<td>22M:014</td>
<td>First Year Seminar</td>
<td></td>
<td></td>
<td>May be repeated 2 times for credit</td>
</tr>
<tr>
<td>MATH:1005</td>
<td>22M:008</td>
<td>College Algebra</td>
<td>MATH:1010 MATH:1020 MATH:1240 or higher</td>
<td>MATH:1005</td>
<td></td>
</tr>
<tr>
<td>MATH:1010</td>
<td>22M:005</td>
<td>Trigonometry</td>
<td>MATH:1020 MATH:1440 or higher</td>
<td>MATH:1010</td>
<td></td>
</tr>
<tr>
<td>MATH:1020</td>
<td>22M:009</td>
<td>Elementary Functions</td>
<td>MATH:1380 MATH:1460 or higher</td>
<td>MATH:1020 MATH:1340 MATH:1440</td>
<td>See Special Consideration 2.</td>
</tr>
<tr>
<td>MATH:1140</td>
<td>22M:081</td>
<td>Geometry for Elementary Teachers</td>
<td></td>
<td>MATH:1140</td>
<td></td>
</tr>
<tr>
<td>MATH:1240</td>
<td>22M:010</td>
<td>Finite Mathematics</td>
<td></td>
<td>MATH:1240</td>
<td></td>
</tr>
<tr>
<td>MATH:1340</td>
<td>22M:013</td>
<td>Mathematics for Business</td>
<td>MATH:1380 MATH:1460 or higher</td>
<td>MATH:1020 MATH:1340 MATH:1440</td>
<td>See Special Consideration 2.</td>
</tr>
<tr>
<td>MATH:1380</td>
<td>22M:017</td>
<td>Calculus and Matrix Algebra for Business</td>
<td>MATH:1550 or higher</td>
<td>MATH:1380 MATH:1460</td>
<td>See Special Consideration 3.</td>
</tr>
<tr>
<td>MATH:1440</td>
<td>22M:015</td>
<td>Mathematics for the Biological Sciences</td>
<td>MATH:1380 MATH:1460 or higher</td>
<td>MATH:1020 MATH:1340 MATH:1440</td>
<td>See Special Consideration 2.</td>
</tr>
<tr>
<td>4-digit course number</td>
<td>3-digit course number</td>
<td>Course Title</td>
<td>Regression charged if student previously completed</td>
<td>Duplication charged if student previously completed</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>MATH:1460</td>
<td>22M:016</td>
<td>Calculus for the Biological Sciences</td>
<td>MATH:1550 or higher</td>
<td>MATH:1380 MATH:1460</td>
<td>See Special Consideration 3.</td>
</tr>
<tr>
<td>MATH:1560</td>
<td>22M:032</td>
<td>Engineering Math II</td>
<td>MATH:2560 MATH:3550 or higher</td>
<td>MATH:1560 MATH:1850</td>
<td>See Special Considerations 5, 6, 7, 8.</td>
</tr>
<tr>
<td>MATH:2150</td>
<td>22M:070</td>
<td>Foundations of Geometry</td>
<td>See your advisor if you have taken MATH:3600 or higher</td>
<td>MATH:2150</td>
<td></td>
</tr>
<tr>
<td>MATH:2560</td>
<td>22M:034</td>
<td>Engineering Math IV</td>
<td>See your advisor if you have taken MATH:3600 or higher</td>
<td>MATH:2560</td>
<td></td>
</tr>
<tr>
<td>MATH:2700</td>
<td>22M:027</td>
<td>Introduction to Linear Algebra</td>
<td>See your advisor if you have taken MATH:3600 or higher</td>
<td>MATH:2550 MATH:2700</td>
<td>See Special Consideration 10.</td>
</tr>
<tr>
<td>MATH:2850</td>
<td>22M:028</td>
<td>Calculus III</td>
<td>See your advisor if you have taken MATH:3600 or higher</td>
<td>MATH:1560 MATH:2850 MATH:3550</td>
<td>See Special Considerations 6, 7, 8, 9.</td>
</tr>
<tr>
<td>MATH:2995</td>
<td>22M:095</td>
<td>Introduction to Research Opportunities</td>
<td></td>
<td>MATH:2995</td>
<td></td>
</tr>
<tr>
<td>MATH:3550</td>
<td>22M:037</td>
<td>Engineering Math V</td>
<td>See your advisor if you have taken MATH:3600 or higher</td>
<td>MATH:2850 MATH:3550</td>
<td>See Special Considerations 8, 9.</td>
</tr>
</tbody>
</table>
Special Considerations

0. MATH:0100/22M:001 and MATH:0300/22M:003 do not earn credit toward graduation. Students should talk with their advisors before enrolling in these classes.

1. A student can earn credit for at most one of MATH:1120/22M:006 or MATH:1130/22M:012.

2. A student will be charged with duplication for taking one of MATH:1020/22M:009, MATH:1340/22M:013 or MATH:1440/22M:015 after any other course in that list. However, each course in the list could be used as a second-grade-only option for another course on the list.

3. A student will be charged with duplication for taking one of MATH:1380/22M:017 or MATH:1460/22M:016 after the other. However, each course could be used as a second-grade-only option for the other course.

4. A student will be charged with duplication for taking one of MATH:1550/22M:031 or MATH:1850/22M:025 after the other. However, each course could be used as a second-grade-only option for the other course.

5. A student taking MATH:1560/22M:032 and MATH:1860/22M:026 will only receive a total of 6 semester hours (instead of 8).

6. A student taking MATH:1560/22M:032 and MATH:2850/MATH:028 will only receive a total of 6 semester hours (instead of 8).

7. A student taking MATH:1560/22M:032, MATH:1860/22M:026, and MATH:2850/22M:028 will only receive a total of 8 semester hours (instead of 12) because the material in MATH:1860 and MATH:2850 includes all of the material in MATH:1560.

8. A student taking MATH:1560/22M:032, MATH:2850/22M:028 and MATH:3550/22M:037 will only earn a total of 7 semester hours (instead of 11) because most of the material in MATH:3550 is included in MATH:2850.

9. A student taking MATH:2850/22M:028 and MATH:3550/22M:037 will only earn a total of 5 semester hours (instead of 7) because most of the material in MATH:3550 is included in MATH:2850.

10. A student taking MATH:2700/22M:027 and MATH:2550/22M:033 will only earn a total of 4 semester hours. (If the student takes MATH:2550 first, then taking MATH:2700 will earn 2 additional hours. If the student takes MATH:2700 first, then taking MATH:2550 is considered regression, and the student earns no additional hours.)
APPENDIX B
DUPLICATION AND SECOND-GRADE-ONLY (SGO) OPTIONS

The Department of Mathematics offers many introductory level courses. This raises questions of duplication (which is assessed when you take a course or its equivalent more than once but the course is not repeatable for credit.) At the same time, many of our courses build on the introductory courses or others, and there are situations of regression (occurs when you take a course that is earlier in the sequence than one you have already taken and passed.). Finally, because students' interests may change, we need to be clear about when one course can be used as a second-grade-only (SGO) for another course.

GUIDING PRINCIPLES
Some examples appear below, but these are just to illustrate the policies; the complete lists are given in the subsequent sections.

1. We offer many service courses, and also have parallel tracks for different majors; so course number is not a safe guide for which course is more advanced than another. This is why the Regression list looks complicated. For example, MATH:1020 is much more advanced than MATH:1340. On the other hand, MATH:1240 is independent of nearly all other undergraduate courses, so there is no Regression in taking MATH:1240 even after taking MATH:3600.

2. There are groups of similar courses given in next few pages. Within a group, usually, taking any two courses means duplication, and any course can be used as SGO for any other. The courses really are different in subject emphasis and sometimes even a little different in level, and the students should be advised carefully in selecting courses. These approximate groupings are a compromise, to give students and advisors reasonable flexibility. For example, one of the "short calculus" courses MATH:1460 or MATH:1380 duplicates the other, and can be used to SGO the other.

Note: Other departments may distinguish between these courses; for example, we do NOT encourage a biological science department to accept MATH:1380 in lieu of MATH:1460, nor a business program to accept MATH:1460 in lieu of MATH:1380.

3. The group-numbers DO represent increasing level. For example, taking any course in Group 2 after passing a course in Group 3 constitutes regression.

4. Some courses have substantial overlap but are different enough to justify not to count them as complete duplications, with a reduction in total credits. This usually occurs with the Engineering courses, see the end of Appendix B, and Appendix C. For example, MATH:1560 (4 s.h.) and MATH:2850 (4 s.h.) together is 6 s.h. total, rather than 8.
POLICY

To meet the needs of diverse students and other departments, we offer several approaches to Calculus at each of several levels. Each course is designed with a certain emphasis and sequencing of topics. We encourage departments, students, and advisors to be careful in selecting appropriate courses and in maintaining the course distinctions.

The Math Department policy on SGOs is not intended to change any policies of other departments or programs regarding which courses satisfy their requirements. The SGO is intended to be used to improve the GPAs of the students. Two courses in the same group are considered similar, but they are not necessarily equivalent. Consequently, some departments or programs may choose to accept one of the courses in a group to satisfy their requirements for their majors, but not necessarily the other courses in the same group. These departmental decisions are not affected by the SGOs the Mathematics Department allows. A student staying in the same major or program should repeat the same course for SGO, unless the first course was not chosen correctly for the current major or program. Students may change majors or programs, and it is desirable to allow alternatives for SGOs. A student changing majors or programs will be served better to take the second course (i) which is in the same group as first course, and (ii) that the new major department or program requires. The rule is simple: the second course you take must be the one that your intended major and/or program requires. If you have any questions about which course to take, then you need to ask the department of your intended major.

Example: A student moving from Biology to Business would be better served taking MATH:1380 than repeating MATH:1460. On the other hand, if the student intends to remain a Biological Sciences major, then the student should be required to SGO MATH:1460 with MATH:1460.

There are six groups of similar courses. Within each group, taking two different courses – or one course twice – constitutes duplication. Within each group, the courses can be used for a Second-Grade Only (SGO) option. Please read the previous pages about the Math Department policy on Duplication and Second Grade Only option.

Group 1: Math Courses Primarily for Education Majors

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Department Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:1120</td>
<td>Logic of Arithmetic</td>
<td>(22M:006)</td>
</tr>
<tr>
<td>MATH:1130</td>
<td>Theory of Arithmetic</td>
<td>(22M:012)</td>
</tr>
</tbody>
</table>

(MATH:1130 is intended for Math specialist. Check with the El Ed Advisor as to see which one is appropriate.)

Group 2: Precalculus Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Department Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:1020</td>
<td>Elementary Functions</td>
<td>(22M:009)</td>
</tr>
<tr>
<td>MATH:1340</td>
<td>Mathematics for Business</td>
<td>(22M:013)</td>
</tr>
<tr>
<td>MATH:1440</td>
<td>Mathematics for the Biological Sciences</td>
<td>(22M:015)</td>
</tr>
</tbody>
</table>
Group 3: **Short Calculus Courses**
MATH:1380 (22M:017) Calculus and Matrix Algebra for Business
MATH:1460 (22M:015) Calculus for the Biological Sciences

Group 4: **First semester Calculus Courses**
MATH:1550 (22M:031) Engineering Math I: Single Variable Calculus
MATH:1850 (22M:025) Calculus I

Group 5: **Second semester Calculus Courses**, **
MATH:1560 (22M:032) Engineering Math II: Multi Variable Calculus
MATH:1860 (22M:026) Calculus II

Group 6: **First semester Calculus Courses**, **
MATH:3550 (22M:037) Engineering Math V: Vector Calculus
MATH:2850 (22M:028) Calculus III

*These (Groups 4-6) are the policies of the Math Department applying to all math majors for their math degrees, major or minor. However, the policies of the Engineering College are different for the students seeking an engineering degree. Engineering majors, please consult with the advisors from the Engineering College.

**The following combinations of the courses have substantial overlap but are different enough to justify not to count them as complete duplications. The Math Department counts these combinations with a reduction in the total credits (if there is no SGO involved) for the students seeking a major or minor in math.**

MATH:1560 + 1860 is 6 s.h. total
MATH:1560 + 2850 is 6 s.h. total
MATH:1560 + 1860 + 2850 is 8 s.h. total,
(since all of MATH:1560 is covered in MATH:1860 or MATH:2850)
MATH:2550 + 2700 is 4 s.h. total,
(since all of MATH:2550 is covered in MATH:2700)
MATH:3550 + 2850 is 5 s.h. total,
(since most of MATH:3550 is included in MATH:2850)
MATH:1560 + 3550 + 2850 is 7 s.h. total.
APPENDIX C: ENGINEERING MATHEMATICS COURSES

The Math Department provides a number of courses designed specifically for students majoring in the College of Engineering. However, many of those courses nearly duplicate the standard mathematics sequence. The table below indicates the course equivalencies or substitutions that the Math Department uses for the math degree requirements. These substitutions are not automatic, please get in touch with the Math Department. The policies of the Engineering College are different, please talk to an advisor from Engineering College if you are planning to earn a degree in engineering.

**For Example:** For a math degree, MATH:1560 satisfies Calculus II, MATH:1860 requirement; but MATH:1860 does not satisfy the Engineering Math II, MATH:1560 requirement.

<table>
<thead>
<tr>
<th>Standard Mathematics Course</th>
<th>Engineering Mathematics Course</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus I MATH:1850 (22M:025)</td>
<td>Engineering Math I: Single Variable Calculus MATH:1550 (22M:031)</td>
<td>Accepted as equivalent for the math major and minor, by the Math Department</td>
</tr>
<tr>
<td>Calculus II MATH:1860 (22M:026)</td>
<td>Engineering Math II: Multi-Variable Calculus MATH:1560 (22M:032)</td>
<td>MATH:1560 is accepted as to satisfy MATH:1860 for the math majors, by the Math Department</td>
</tr>
<tr>
<td>Introduction to Linear Algebra MATH:2700 (22M:027) 4 semester hours</td>
<td>Engineering Math III: Matrix Algebra MATH:2550 (22M:033) 2 semester hours</td>
<td>MATH:2550 (2 sh) does not satisfy the linear algebra (4 sh) requirement for the math majors. Math majors may take one more post-calculus math course to satisfy the MATH:2700 requirement*, OR Students may choose to take MATH:2550 + MATH:2700 for a total of 4 s.h.**,</td>
</tr>
<tr>
<td>Intro. to Ordinary Differential Equations MATH:3600 (22M:100)</td>
<td>Engineering Math IV: Differential Equations MATH:2560 (22M:034)</td>
<td>Accepted as equivalent</td>
</tr>
</tbody>
</table>

*Many students use MATH:3800 Elementary Numerical Analysis. However, students with good grades in MATH:2550 are recommended to MATH:4040 Matrix Theory (22M:127) for a solid background in linear algebra instead of taking MATH:2700. **Students who struggled in MATH:2550 are recommended to take MATH:2700.
PREREQUISITE CHART for ENGINEERING VERSUS STANDARD MATH

MATH:1005 (22M:008) College Algebra

MATH:1020 (22M:009) Elementary Functions (Pre-calculus)

MATH:1010 (22M:005) Trigonometry
   Also must have 1005 or 1340 before taking Calc. 1550 or 1850

MATH:1850 (22M:025) Calculus I

MATH:1550 (22M:031) Engineering Math I: Single Variable Calculus

MATH:1860 (22M:026) Calculus II

MATH:2700 (22M:027) Intro to Linear Algebra

MATH:2850 (22M:028) Calculus III

MATH:3600 (22M:100) Intro to Ordinary Differential Equations

MATH:3800 (22M:72) Elem. Numerical Analysis

MATH:1560 (22M:032) Engineering Math II: Multi-Variable Calculus
   (See Engineering Dept. for further course information)

MATH:2550 (22M:033) Engineering Math III: Matrix Algebra

MATH:2560 (22M:034) Engineering Math IV: Differential Equations

MATH:3550 (22M:037) Engineering Math V: Vector Calculus

MATH:2560 must be taken before or concurrently with 3550

To Take 2560: 2850 suffices instead of 1560, and 2700 suffices instead of 2550

Both 1860 & 2700 (or 1560 & 2550) are required for 3800

2850 must be taken before or concurrently with 3600

1860 & 2700 can be taken concurrently; Similarly, 2700 & 2850

2560 must be taken before or concurrently with 3550
TRANSFERRING FROM ENGINEERING TO MATH

We will only discuss the transferring from Engineering to Math. The policies of the Engineering College are different. Please talk to an advisor from Engineering College if you are planning to earn a degree in engineering, and want to see how they count your previous math courses.

Please read Appendix B, for the Duplication and the Second-Grade Only (SGO) options for the engineering math courses and the standard math courses, as well as the reduction of credit for partial duplication in the absence of SGO. In general, students staying in only one sequence is advised.

- Standard math: MATH:1850, 1860, 2700, 2850, 3600 (total of 19 sh)
- Engineering math: MATH:1550, 1560, 2550, 2560, 3550 (total of 16 sh)

If changing from one sequence to the other is better for the student, then it should be done only once. Going back and forth between sequences is not advisable, due to the loss of semester hours and time. The substitutions mentioned are not automatic for the math majors, please get in touch with the Math Department. For example, in order MATH:1550 and 1560 to satisfy MATH:1850 and 1860 requirement for a math major, the Math Department needs to inform the Registrar, and this needs to be initiated by the student talking to the student’s math advisor.

If you wish to transfer from an Engineering major to PROGRAM A Mathematics major, you need to satisfy the standard math sequence MATH:1850, 1860, 2700, 2850, 3600 (total of 19 sh) and the two proofs courses: MATH:3720 and 3770 to complete the core courses. In general, we encourage the students to move forward and not take courses duplicating some of the engineering sequence. Please follow the recommendations below for completing MATH: MATH:1850, 1860, 2700, 2850, 3600 requirements. Also, make sure to take the proofs courses MATH:3720 and 3770, which have no engineering versions.

For PROGRAM B or C, consult the Math Department. Particularly for Program C, the students should learn about the Engineering subtrack.

From the Engineering Sequence MATH:1550, 1560, 2550, 2560, 3550 (total of 16 sh), if you completed only:

- **MATH:1550:**
  - Do not take MATH:1850
  - Take MATH:1860 and the rest of regular math sequence

- **MATH:1550 and 1560:**
  - Do not take MATH:1850 or 1860
  - Take MATH:2700 and the rest of regular math sequence

- **MATH:1550, 1560 and 2550:**
  - Do not take MATH:1850 or 1860
  - Choose one of the options: (i) take MATH:2700 for an additional 2 sh, or (ii) take an additional post-calculus course (such as MATH:3800) or (iii) take MATH:4040 if you need to have a solid basis in linear algebra (such as going to grad school in math or sciences or engineering).
  - Take MATH:2850 and 3600
• MATH:1550, 1560, 2550 and 2560: (Option I)
  ▪ Do not take MATH:1850 or 1860 or 3600
  ▪ Choose one of the options: (i) take MATH:2700 for an additional 2 sh, or (ii) take an additional post-calculus course (such as MATH:3800) or (iii) take MATH:4040 if you need to have a solid basis in linear algebra (such as going to grad school in math or sciences or engineering).
  ▪ Take MATH:2850 for a solid background in multivariable calculus.

• MATH:1550, 1560, 2550 and 2560: (Option II)
  ▪ Do not take MATH:1850 or 1860 or 2700 or 3600
  ▪ Choose two courses from the list MATH:3800, 4040, 4500, 4610, 5600, 5700, 5800, 5810. Rationale: Count the semester hours, you have taken 13 sh in engineering math, but the standard math sequence is 19 sh.

• MATH:1550, 1560, 2550, 2560 and 3550:
  ▪ Do not take MATH:1850 or 1860 or 2700 or 2850 or 3600
  ▪ Choose one course from the list MATH:3800, 4040, 4500, 4610, 5600, 5700, 5800, 5810. Rationale: Count the semester hours, you have taken 16 sh in engineering math, but the standard math sequence is 19 sh.

If the recommendation above are not followed, you may have one or more of the following combinations with substantial overlap. The Math Department counts these combinations with a reduction in the total credits (if there is no SGO involved) for the students seeking a major or minor in math.

MATH:1560 + 1860 is 6 s.h. total
MATH:1560 + 2850 is 6 s.h. total
MATH:1560 + 1860 + 2850 is 8 s.h. total, (since all of MATH:1560 is covered in MATH:1860 or MATH:2850)
MATH:2550 + 2700 is 4 s.h. total, (since all of MATH:2550 is covered in MATH:2700)
MATH:3550 + 2850 is 5 s.h. total, (since most of MATH:3550 is included in MATH:2850)
MATH:1600 + 3550 + 2850 is 7 s.h. total.
## APPENDIX D: MATH COURSE NUMBERS

<table>
<thead>
<tr>
<th>NEW COURSE 4-digit number</th>
<th>OLD COURSE 3-Digit Number</th>
<th>COURSE TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:0100</td>
<td>22M:001</td>
<td>Basic Algebra I</td>
</tr>
<tr>
<td>MATH:0300</td>
<td>22M:003</td>
<td>Basic Geometry</td>
</tr>
<tr>
<td>MATH:1000</td>
<td>22M:014</td>
<td>First-Year Seminar</td>
</tr>
<tr>
<td>MATH:1005</td>
<td>22M:008</td>
<td>College Algebra</td>
</tr>
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<td>MATH:1010</td>
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