MATHEMATICS

Description
A strong mathematics background is essential to an increasing variety of careers. The Department of Mathematics encourages students to select a coherent body of courses in mathematics and in other disciplines that are consistent with their academic and career goals.

The Department of Mathematics offers a bachelor of arts program as well as a bachelor of science program with four specialty options. Each student pursuing the bachelor of science should select an option that meets their academic and career needs by completing a Program Declaration form in consultation with the department's faculty advisor. Ideally, this should be done prior to completing two mathematics courses beyond the calculus sequence. As appropriate, students can change their Program Declaration to select a different option or modify the program of study subject to the approval of the faculty advisor.

Program Assessment. In order to assist the department in evaluating its programs, all majors should plan to participate in an exit interview during their last semester before graduation. Please make arrangements with the faculty advisor.

Admission
College Admission
The entrance requirements for the College of Arts and Sciences are the same as the UNL General Admission Requirements. Students who are admitted through the Admission by Review process may have certain conditions attached to their enrollment at UNL. These conditions are explained under “Removal of Deficiencies.”

In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language in high school. Four years of high school coursework in the same language will fulfill the College of Arts and Sciences’ language requirement. It will also allow students to continue language study at a more advanced level at UNL, and provide more opportunity to study abroad.

Advising
Academic and Career Advising Center in 107 Oldfather is a centrally located and easily accessed resource for students in all majors in the College of Arts and Sciences. The professional academic advisors and career coaches offer 1-1 meetings on a walk-in and appointment basis weekdays. Advisors will provide assistance choosing majors and minors, understanding degree requirements and academic policies, completing paperwork, meeting deadlines, adding/dropping courses, and planning for graduation. In addition, career coaches can help students identify career options related to their interests and connect them with experiences like internships, research, and more that will prepare them for those career options. These specially trained advisors and coaches also serve as first point of contact in the College for all incoming freshmen and transfer students during New Student Enrollment.

Students in the College who have declared a major will be assigned an academic advisor who is their first point of contact for a variety of questions. Academic advisors help students be successful in adjusting to UNL overall as well as making progress toward degree completion. The assigned advisor may be located within the department of their primary major, or in the Advising Center. Students can identify their assigned advisor in MyRED on the academics tab. In addition, faculty advisors are experts in their discipline, including advanced coursework and requirements, opportunities for research, student organizations, and considering graduate school in the discipline. Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love Library South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, contact the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, http://cas.unl.edu/advising.

College Degree Requirements
College Distribution Requirements
Bachelor of Arts or Bachelor of Science (16 hours + Language)
The College of Arts and Sciences distribution requirements are designed to ensure a breadth of courses within the liberal arts degree. By engaging in study in several different areas within the College, students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements.

• A student may not use a single course to satisfy both an ACE outcome and a College distribution requirement.
• A student may not use a single course to satisfy more than one College Distribution Requirement.
• A student may not use a course from their primary major to satisfy the Breadth Requirement (F), but may apply an ancillary requirement of the primary major or a course from their second major toward this requirement.
• Independent study, directed readings, or internship courses cannot be used to satisfy a College Distribution Requirement.
• Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

College Distribution Requirements
CDR A - Written Communication 3
Select from courses approved for ACE outcome 1.
CDR B and BL - Natural, Physical, and Mathematical Sciences with Lab 4
Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, physics and statistics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology and physics.

Some courses from geography and anthropology may also be used to satisfy the lab requirement above. 1

CDR C - Humanities 3
Select from classics, English, history, modern languages and literatures, philosophy, and religious studies. 2

CDR D - Social Science 3
Select from anthropology, communication studies, geography, political science, psychology, or sociology. 3

CDR E - Language 0-16

1. Some exceptions may be made for courses that have significant coursework beyond the lab component.
2. Some exceptions may be made for courses that have significant coursework beyond the lab component.
3. Some exceptions may be made for courses that have significant coursework beyond the lab component.
Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies, or modern languages and literatures. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Russian, and Spanish.

A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement, but encouraged to continue on in their language study.

<table>
<thead>
<tr>
<th>CDR F - Additional Breadth</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select from natural, physical and mathematical sciences (Area B), humanities (Area C), or social sciences (Area D). Cannot be a course from the primary major.</td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 16-32

1. See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.
2. Language courses numbered 210 and below do not fulfill the CDR C.
3. See Degree Audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

Scientific Base

Bachelor of Science Only (60 hours)
The bachelor of science degree requires students to complete 60 hours in mathematical, physical and natural sciences. Approved courses for scientific base credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOL 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), computer science (excluding CSCE 10), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology, physics and statistics.

See your degree audit or a College of Arts and Sciences advisor for a complete list including individual classes that fall outside of the disciplines listed above. Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of a college advisor.

Language Requirement

UNL and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The UNL entrance requirement of two years of the same foreign language or the College's language distribution requirement (CDR E) will rarely be waived and only with relevant documentation. See the main College of Arts and Sciences page for more details.

Minimum Hours Required for Graduation

A minimum of 120 semester hours of credit is required for graduation from the College of Arts and Sciences. A total grade point average of at least 2.0 is required.

Grade Rules

Restrictions on C- and D Grades

The College will accept no more than 15 semester hours of C- and D grades from other domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No UNL C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege

The College of Arts and Sciences adheres to the University regulations for the Pass/No Pass (P/N) privilege with the following additional regulations:

- Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences departments and programs do not allow courses graded Pass/No Pass to apply to the major or minor. Students should refer to the department's or program's section of the catalog for clarification. By college rule, departments can allow up to 6 hours of Pass/No Pass in the major or minor.
- Departments may specify that certain courses of theirs can be taken only on a P/N basis.
- The college will permit no more than a total of 24 semester hours of P/N grades to be applied toward degree requirements. This total includes all Pass grades earned at UNL and other U.S. schools. NOTE: This 24-hour limit is more restrictive than the University regulation.

Grading Appeals

A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk to the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor's department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean's Office, 1223 Oldfather Hall.

Course Level Requirements

Courses Numbered at the 300 or 400 Level

Thirty (30) of the 120 semester hours of credit must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 hours (1/2) must be completed in residence at UNL.

Residency Requirement

Students must complete at least 30 of the 120 total hours for their degree at UNL. Students must complete at least 1/2 of their major coursework including 6 hours at the 300 or 400 level in their major, and 15 of the 30 hours required at the 300 or 400 level in residence. Credit earned during education abroad may be used toward the residency requirement only if students register through UNL.

ACE Requirements

Consistent with the mission and values of the University, ACE is based on a shared set of four institutional objectives and ten student learning outcomes. The ACE program was approved by faculty in all eight undergraduate colleges and endorsed by the Faculty Senate, the student government, and the Academic Planning Committee in January 2008.
for implementation in the fall 2009. ACE aligns with current national initiatives in general education.

To meet the ACE Program requirement, a student will complete a minimum of 3 credit hours for each of the ten ACE Student Learning Outcomes (a total of 30 ACE credit hours). See the ACE website at: http://ace.unl.edu for the most current information and the most recently certified courses.

**Catalog to Use**

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at UNL. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at UNL in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991 the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

**Learning Outcomes**

Graduates of mathematics will be able to:

1. Reason quantitatively, using numeric, algebraic, and analytic methods.
2. Use mathematics to model and address real-world problems.
3. Understand, create, and explain mathematical arguments, organized by means of definitions, results, proofs and examples.

**Major Requirements**

**Bachelor of Science**

Complete the core requirements and one of the following options: Standard, Education, Statistics, Mathematics of Physical Phenomena, Mathematical Biology, Mathematical Finance, Discrete Mathematics and Cryptography.

### Core Requirements

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 314</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credit Hours Subtotal:</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Option Courses**

Select one of seven options described below to complete the major.

**Credit Hours Subtotal:** 30-43

**Total Credit Hours** 42-55

### Standard Option

Recommended for students wishing to combine a strong mathematics education with research or a coherent body of coursework in another discipline.

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 310</td>
<td>Introduction to Modern Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 325</td>
<td>Elementary Analysis</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credit Hours Subtotal:</strong></td>
<td></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>

**Additional MATH Courses**

Select four additional advanced MATH courses with at least two at the 400 level.

**Credit Hours Subtotal:** 12

**Minor, 2nd Major, or Research Experience**

Students pursuing the Standard Option should accompany the math major with a minor, 2nd major, or approved 18-hour concentration in another area. An approved significant research experience including thesis, UCARE, or REU may be used.

**Credit Hours Subtotal:** 18

**Total Credit Hours** 43

### Education Option

Recommended for students planning to pursue endorsement and certification to teach mathematics at the secondary level through an undergraduate degree in the College of Education and Human Sciences or through a graduate program.

**Required Courses**

<table>
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</tr>
<tr>
<td>MATH 325</td>
<td>Elementary Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 350</td>
<td>Geometry for High School Teaching</td>
<td>3</td>
</tr>
<tr>
<td>MATH 405</td>
<td>Discrete and Finite Mathematics for High School Teaching</td>
<td>3</td>
</tr>
<tr>
<td>MATH 407</td>
<td>Mathematics for High School Teaching I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 408</td>
<td>Mathematics for High School Teaching II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credit Hours Subtotal:</strong></td>
<td></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

**An education major or minor**

Students pursuing the Education Option should accompany the math major with a 2nd major in education, likely through dual matriculation or intercollege study with the College of Education and Human Sciences. An education minor or approved 18-hour concentration related to education may also be used to meet this requirement.

**Credit Hours Subtotal:** 18

**Total Credit Hours** 43

### Statistics Option

Recommended for students interested in a mathematics major and a strong body of coursework in statistics.

**Required Courses**

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</tr>
<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credit Hours Subtotal:</strong></td>
<td></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>

**Additional Mathematics Courses**

Select four additional advanced mathematics courses with at least two at the 400 level.

**Credit Hours Subtotal:** 12

**Additional Statistics Courses**
Select three additional statistics courses at the 300 or 400 level.

Credit Hours Subtotal: 9

Total Credit Hours 34

**Mathematics and Physical Phenomena Option**

Recommended for students interested in pairing a strong mathematics education with a body of coursework concerning the physical world that we live in.

**Required Courses**

- MATH 208 Calculus III 4
- MATH 221 Differential Equations 3
- MATH 309 Introduction to Mathematical Proofs 3
- MATH 325 Elementary Analysis 3

Credit Hours Subtotal: 13

**Additional Mathematics Courses**

Select two additional advanced mathematics courses at the 400 level.

Credit Hours Subtotal: 6

**Physics Courses**

- PHYS 211 General Physics I 4
- PHYS 212 General Physics II 4

Credit Hours Subtotal: 8

**Physical Phenomena Sequence**

Select and complete one of the following sequences from 6-16 physics, meteorology, geology, or engineering:

- PHYS 213 General Physics III and Mechanics
- PHYS 213 General Physics III and Thermal Physics
- PHYS 213 General Physics III and Electromagnetic Theory
- PHYS 311 Mechanics and Computational Physics
- METR 100 Weather and Climate and Introduction to Atmospheric Science and Atmospheric Thermodynamics and Dynamic Meteorology I
- METR 100 Weather and Climate and Introduction to Atmospheric Science and Atmospheric Thermodynamics and Physical Meteorology
- METR 100 Weather and Climate and Introduction to Geophysics and Water & Earth Connections
- GEOL 101 Dynamic Earth and Introduction to Geophysics and Water & Earth Connections
- GEOL 106 Environmental Geology and Introduction to Geophysics and Water & Earth Connections
- MECH 223 Engineering Statics and Fluid Mechanics and Engineering Dynamics
- MECH 223 Engineering Statics and Engineering Dynamics and Advanced Dynamics
- MECH 223 Engineering Statics and Engineering Dynamics and Introduction to Mechanical Vibrations
- MECH 223 Engineering Statics and Engineering Dynamics and Introduction to Finite Element Analysis

Credit Hours Subtotal: 6-16

Total Credit Hours 33-43

**Mathematical Biology Option**

Recommended for students interested in a mathematics major and a strong body of coursework concerning biology and the mathematics of biological science.

**Required Courses**

- MATH 221 Differential Equations 3
- MATH 309 Introduction to Mathematical Proofs 3
- MATH 325 Elementary Analysis 3
- MATH 439 Mathematical Models in Biology 3
- STAT 380 Statistics and Applications 3

Credit Hours Subtotal: 15

**Additional Mathematics Courses**

Select two additional advanced mathematics courses at the 400 level.

Credit Hours Subtotal: 6
Biological Sciences Courses

LIFE 120 & LIFE 120L
Fundamentals of Biology I and Fundamentals of Biology I Laboratory 4

LIFE 121 & LIFE 121L
Fundamentals of Biology II and Fundamentals of Biology II Laboratory 4

Select one of the following sequences: 7-8

BIOS 206 & BIOS 337
General Genetics and Applications of Bioinformatics

BIOS 206 & BIOS 426
General Genetics and Systems Biology

BIOS 206 & BIOS 427
General Genetics and Practical Bioinformatics Laboratory

BIOS 207 & BIOS 453
Ecology and Evolution and Predator Ecology

BIOS 207 & BIOS 452
Ecology and Evolution and Field Epidemiology

Credit Hours Subtotal: 15-16
Total Credit Hours 36-37

Mathematical Finance Option
Recommended for students interested in a mathematics major and a strong body of coursework in actuarial science and finance.

Required Courses

MATH 208 Calculus III 4
MATH 221 Differential Equations 3
STAT 380 Statistics and Applications 3

Credit Hours Subtotal: 10

Additional Mathematics and Statistics Courses
Select two courses from the following: 6

MATH 309 Introduction to Mathematical Proofs
MATH 310 Introduction to Modern Algebra
MATH 325 Elementary Analysis
MATH 487 Probability Theory 3-4
or STAT 462 Introduction to Mathematical Statistics I: Distribution Theory
MATH 489 Stochastic Processes 3
Select one additional advanced mathematics courses at the 400 level.

Credit Hours Subtotal: 15-16

Actuarial Science or Finance Courses

ACTS 440 Interest Theory 4
ACTS 441 Introduction to Financial Economics 3
FINA 467A Options, Futures and Derivative Securities for Actuarial Science 3

Credit Hours Subtotal: 10
Total Credit Hours 35-36

Discrete Mathematics and Cryptography Option
Recommended for students wishing to combine a strong mathematics education with a coherent body of coursework in computer science focused on discrete mathematics and cryptography.

Required Courses

MATH 208 Calculus III 3-4
or MATH 221 Differential Equations

or STAT 380 Statistics and Applications
MATH 309 Introduction to Mathematical Proofs 3
MATH 310 Introduction to Modern Algebra 3

Credit Hours Subtotal: 9-10

Additional Mathematics Courses
Select one course from the following: 3

MATH 417 Group Theory
MATH 428 Principles of Operations Research
MATH 445 Number Theory
MATH 450 Combinatorics
MATH 452 Graph Theory

Select two additional advanced mathematics courses at the 400 level.

Credit Hours Subtotal: 9

Computer Science Courses

CSCE 155A Computer Science I 3
or CSCE 155E Computer Science I: Systems Engineering Focus
or CSCE 155H Honors: Computer Science I
or CSCE 155N Computer Science I: Engineering and Science Focus
or CSCE 155T Computer Science I: Informatics Focus
CSCE 311 Data Structures and Algorithms for Informatics 3

Select two courses from the following: 6

CSCE 423 Design and Analysis of Algorithms
CSCE 424 Computational Complexity Theory
CSCE 428 Automata, Computation, and Formal Languages
CSCE 463 Data and Network Security
CSCE 477 Cryptography and Computer Security

Credit Hours Subtotal: 12
Total Credit Hours 30-31

Bachelor of Arts
The BA program is ideal for the student who wants to combine a mathematics major with another major or several minors in the humanities or the social sciences or for the student dual matriculating with another college.

Core Requirements

MATH 106 Calculus I 5
MATH 107 Calculus II 4
MATH 208 Calculus III 4
MATH 221 Differential Equations 3
or STAT 380 Statistics and Applications
MATH 310 Introduction to Modern Algebra 3
MATH 314 Linear Algebra 3
MATH 325 Elementary Analysis 3

Total Credit Hours 25

Specific Major Requirements

Additional Advanced Mathematics Courses

Select three additional advanced mathematics courses with at least two at the 400 level.

Required Courses

MATH 208 Calculus III 3-4
or MATH 221 Differential Equations
Credit Hours Subtotal: 9
Total Credit Hours 9

Additional Major Requirements

Restriction
Students with previous credit in any calculus course (that is, MATH 104 or MATH 106, MATH 107, or MATH 208 or their honors versions) may not register for or earn credit toward their degree with any math course numbered below 104 unless given permission by the math department advisor. All special topics, independent study, seminar, and reading courses require permission of the instructor before registering; and these courses do not count toward the major requirements unless approved by the faculty advisor.

Grade Rules

C- and D Grades
A grade of C or higher is required in all courses in the major or minor.

Pass/No Pass
No calculus course taken Pass/No Pass will count toward the major or minor. No more than 3 hours of the advanced courses taken as Pass/No Pass will be counted toward the major or minor.

Requirements for Minor Offered by Department

Plan A Minor (18-19 hours)
A complete calculus sequence plus two advanced mathematics courses OR two calculus courses with three advanced mathematics courses.

Required Calculus Courses

<table>
<thead>
<tr>
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<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td>4</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 9

Additional MATH Courses
Select three additional mathematics courses from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
<td>9-10</td>
</tr>
</tbody>
</table>

Advanced Mathematics Courses

Credit Hours Subtotal: 9-10

Total Credit Hours 18-19

Plan B Minor (12-13 hours)
A complete calculus sequence OR complete two calculus courses plus one advanced mathematics course.

Required Calculus Courses

<table>
<thead>
<tr>
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<td>MATH 107</td>
<td>Calculus II</td>
<td>4</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 9

Additional MATH Course
Select one additional mathematics course from the following:

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 3-4

Total Credit Hours 12-13

Restriction
Students with previous credit in any calculus course (that is, MATH 104 or MATH 106, MATH 107, or MATH 208 or their honors versions) may not register for or earn credit toward their degree with any math course numbered below 104 unless given permission by the math department advisor. All special topics, independent study, seminar, and reading courses require permission of the instructor before registering; and these courses do not count toward the major requirements unless approved by the faculty advisor.

Grade Rules

C- and D Grades
A grade of C or higher is required in all courses in the major or minor.

Pass/No Pass
No calculus course can be taken Pass/No Pass. No more than 3 hours of the advanced courses taken as Pass/No Pass will be counted toward the major or minor.

MATH 100A Intermediate Algebra
Prerequisites: Appropriate score on the Math Placement Exam.
Notes: Credit earned in MATH 100A will not count toward degree requirements.
Description: Review of the topics in a second-year high school algebra course taught at the college level. Includes: real numbers, 1st and 2nd degree equations and inequalities, linear systems, polynomials and rational expressions, exponents and radicals. Heavy emphasis on problem solving strategies and techniques.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 100A; MATH 101; MATH 103
Groups: Introductory Mathematics

MATH 101 College Algebra
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A.
Notes: Credit for both MATH 101 and 103 is not allowed; students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.
Description: Real numbers, exponents, factoring, linear and quadratic equations, absolute value, inequalities, functions, graphing, polynomial and rational functions, exponential and logarithmic functions, system of equations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CHEM 105; CRIM 300; MATH 102; MATH 104; METR 100; METR 140; MSYM 109; PHYS 260; PHYS 261
Groups: Introductory Mathematics
MATH 102 Trigonometry
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101.
Notes: Credit for both MATH 102 and 103 is not allowed; students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.
Description: Trigonometric functions, identities, trigonometric equations, solution of triangles, inverse trigonometric functions and graphs.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC
Prerequisite for: AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 458, AGRO 858, NRES 458, NRES 858, SOIL 458; ASCI 340; CHEM 109; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; GEOL 400; MATH 104; MATH 106; METR 100; METR 140; MSYM 109; NAVS 331; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261
Groups: Introductory Mathematics

MATH 103 College Algebra and Trigonometry
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A.
Notes: Credit for both MATH 101 and 103 is not allowed; credit for both MATH 102 and MATH 103 is not allowed; students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.
Description: First and second degree equations and inequalities, absolute value, functions, polynomial and rational functions, exponential and logarithmic functions, trigonometric functions and identities, laws of sines and cosines, applications, polar coordinates, systems of equations, graphing, conic sections.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 458, AGRO 858, NRES 458, NRES 858, SOIL 458; ASCI 340; CHEM 109; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; MATH 104; MATH 106; METR 100; METR 140; MSYM 109; NAVS 331; PHYS 141; PHYS 141H; PHYS 260; PHYS 261; SOFT 160; SOFT 160H
Groups: Introductory Mathematics

MATH 104 Applied Calculus
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101, MATH 102 or MATH 103.
Description: Rudiments of differential and integral calculus with applications to problems from business, economics, and social sciences.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 458, AGRO 858, NRES 458, NRES 858, SOIL 458; ASCI 340; CHEM 109; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; MATH 104; MATH 106; METR 100; METR 140; MSYM 109; NAVS 331; PHYS 141; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 106 Calculus I
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 102 or MATH 103.
Notes: Credit for both MATH 104 and MATH 106 is not allowed.
Description: Functions of one variable, limits, differentiation, exponential, trigonometric and inverse trigonometric functions, maximum-minimum, and basic integration theory (Riemann sums) with some applications.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 472, AGRO 872, NRES 472, NRES 872, SOIL 472, WATS 472; ASCI 330; ASCI 340; BIOS 316, MATH 316, NRES 316; BIOS 316L; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 355; CHEM 109; CHEM 114; CIVE 221, CONE 221; CNST 241; CNST 252; CNST 306; CSCE 155A; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 155N; CSCE 155T; CSCE 156; CSCE 235; CSCE 235H; ECEN 103; ECEN 215; ECEN 215H; ECEN 311; FDST 363; FNSM 363; FINA 361; FINA 361H; GEOL 410; MATH 106; MATH 107; MATH 107H; MATH 107H; MECH 220; METR 100; METR 140; METR 205; MNGT 301; MNGT 301H; MRKT 341H; RAIF 341H; MSYM 109; PHYS 141; PHYS 141H; PHYS 211H; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics
MATH 107H Honors: Calculus II
Prerequisites: Good standing in the University Honors Program or by invitation; and a grade of "B" or better in MATH 106 or equivalent
Description: For course description, see MATH 107.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AREN 211; BLAW 371; BLAW 371H; BLAW 372H; BSEN 244; CHME 202; CHME 331; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 211; ECEN 224; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 208H; MATH 221; MATH 221H; MATH 309; MATH 314; MATH 314H; MECH 223; MECH 223H; METR 100; METR 140; METR 223; MNGT 301; MNGT 301H; MRKT 341H; RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211H; PHYS 212; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 380, STAT 380H, RAIK 270H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 107R Analytic Geometry and Calculus II
Prerequisites: A grade of P, C or better in MATH 106.
Description: Integration theory, techniques of integration, applications of definite integrals, series, Taylor series, vectors, cross and dot products, lines and planes, space curves.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; ASTR 204; BLAW 371; BLAW 371H; BLAW 372; BSEN 244; CHME 202; CHME 331; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 211; ECEN 224; ECON 311; FINA 361; FINA 361H; MATH 107; MATH 208; MATH 221; MATH 221H; MATH 309; MATH 314; MATH 314H; MECH 223; MECH 223H; METR 100; METR 140; METR 223; MNGT 301; MNGT 301H; MRKT 341H; RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211H; PHYS 212; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 380, STAT 380H, RAIK 270H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 189H University Honors Seminar
Prerequisites: Good standing in the University Honors Program or by invitation.
Description: For course description, see MATH 189.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: METR 100; METR 140; PHYS 141; PHYS 260; PHYS 261
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 198 Freshman Seminar
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 24
Format: LEC
Prerequisite for: METR 100; METR 140; PHYS 141; PHYS 260; PHYS 261
Groups: Seminars,Ind Study, Topics

MATH 198H Honors: Freshman Seminar
Prerequisites: Good standing in the University Honors Program or by invitation.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Format: LEC
Prerequisite for: METR 100; METR 140; PHYS 141; PHYS 260; PHYS 261
Groups: Seminars,Ind Study, Topics

MATH 203 Contemporary Mathematics
Notes: Not open to students with credit or concurrent enrollment in MATH 106 or MATH 203J.
Description: Applications of quantitative reasoning and methods to problems and decision making in the areas of management, statistics, and social choice. Includes networks, critical paths, linear programming, sampling, central tendency, inference, voting methods, power index, game theory, and fair division problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 203J Contemporary Math
Prerequisites: Must be admitted to the College of Journalism
Notes: Not open to students with credit or concurrent enrollment in MATH 106 or MATH 203.
Description: Applications of quantitative reasoning and methods to problems and decisions making in areas of particular relevance to College of Journalism and Mass Communication, such as governance, finance, statistics, social choice, and graphical presentation of data. Financial mathematics, statistics and probability (sampling, central tendency, and inference), voting methods, power index, and fair division problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics
MATH 208 Calculus III  
**Prerequisites:** A grade of P, C or better in MATH 107  
**Description:** Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green's Theorem, and applications.  
**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC  
**Prerequisite for:** ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACTS 401; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 221; MATH 310; MATH 310H; MATH 314; MATH 325; MATH 495; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; METR 311; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211H; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462  
**ACE:** ACE 3 Math/Stat/Reasoning  
**Groups:** Introductory Mathematics

MATH 221 Differential Equations  
**Prerequisites:** A grade of P, C, or better in MATH 107 or MATH 107H  
**Description:** First- and second-order methods for ordinary differential equations including: separable, linear, Laplace transforms, linear systems, and some applications.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** AGEN 303, BSEN 303; AGEN 344, BSEN 344; AGEN 350, BSEN 350; AGEN 953, BSEN 957, CIVE 957, GEOL 957; BSEN 260, AG 206; BSEN 311; BSEN 326, CIVE 326, BSEN 326H, CIVE 326H; BSEN 943; BSEN 954, NRES 954; CHME 312; CHME 815, CHME 835, CIVE 310; CIVE 310H; ECEN 213; ECEN 216, ECEN 304; ECEN 306; ECEN 328; MATH 430; MATH 435; MATH 442; MATH 456; MECH 310, MECH 310H; MECH 318; MECH 330; MECH 381; MECH 449, MECH 849; MECH 454, MECH 854; MECH 880; MECH 881; MECH 925; MECH 933; MECH 936; MECH 938; MECH 939; METR 312; PHYS 311; PHYS 422, PHYS 822, ECEN 422, ECEN 822  
**ACE:** ACE 3 Math/Stat/Reasoning

MATH 221H Honors: Differential Equations  
**Prerequisites:** Good Standing in the University Honors Program and a grade of P, C, or better in MATH 107 or MATH 107H  
**Description:** For course description, see MATH 221/821.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** AGEN 303, BSEN 303; AGEN 344, BSEN 344; AGEN 350, BSEN 350; BSEN 260, AG 206; BSEN 311; BSEN 326, CIVE 326, BSEN 326H, CIVE 326H; CIVE 310; CIVE 310H; ECEN 213; ECEN 216, ECEN 304; ECEN 306; ECEN 328; MATH 430; MATH 435; MATH 442; MATH 456; MECH 310, MECH 310H; MECH 318; MECH 330; MECH 381; MECH 449, MECH 849; MECH 454, MECH 854; MECH 880; MECH 881; MECH 925; MECH 933; MECH 936; MECH 938; MECH 939; METR 312; PHYS 311  
**ACE:** ACE 3 Math/Stat/Reasoning

MATH 208H Honors: Calculus III  
**Prerequisites:** Good Standing in the University Honors Program and a grade of P, C, or better in MATH 107 or MATH 107H  
**Description:** Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green's Theorem, and applications.  
**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC  
**Prerequisite for:** ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACTS 401; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 221; MATH 310; MATH 310H; MATH 314; MATH 325; MATH 495; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; METR 311; MNGT 301; MNGT 301H; MRKT 341H, RA IK 341H; PHYS 141H; PHYS 151; PHYS 211H; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462  
**ACE:** ACE 3 Math/Stat/Reasoning  
**Groups:** Introductory Mathematics

MATH 300 Mathematics Matters  
**Prerequisites:** TEAC 308 or TEAC 416D or parallel.  
**Notes:** Credit toward the degree may be earned in only one of: MATH 300 or MATH 300M.  
**Description:** Numbers and operations. Develop an understanding of mathematics taught in the elementary school.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** MATH 301; TEAC 297E; TEAC 308  
**Groups:** Introductory Mathematics
MATH 300M Mathematics as a Second Language  
**Prerequisites:** Must be degree seeking in the College of Education & Human Sciences.  
**Notes:** Open only to a middle grades teaching endorsement program student. Credit towards degree may be earned in only one of: MATH 300, or MATH 300M.  
**Description:** Develop a deeper understanding of "number and operations". The importance of careful reasoning, problem solving, and communicating mathematics, both orally and in writing. Connections with other areas of mathematics and the need for developing the "habits of mind of a mathematical thinker".  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics

MATH 301 Geometry Matters  
**Prerequisites:** MATH 300, with a grade of C or Pass or better.  
**Notes:** Credit towards the degree may be earned in only one of: MATH 301.  
**Description:** Geometry and measurement. Develop an understanding of geometry as taught in the elementary school.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics

MATH 302 Math Modeling  
**Notes:** MATH 300 is a strongly recommended prerequisite. Intended for middle grades teaching endorsement majors with a mathematics emphasis and/or to elementary education majors who want a mathematics concentration.  
**Description:** Using mathematics to model solutions or relationships for realistic problems taken from the middle school curriculum. The mathematics for these models are a mix of algebra, geometry, sequences (dynamical systems, queuing theory), functions (linear, exponential, logarithmic), and logic. Mathematical terminology, concepts and principles. Calculator based lab devices, graphing calculators, and computers as tools to collect data, to focus on concepts and ideas, and to made the mathematics more accessible.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics

MATH 304 Experimentation, Conjecture, and Reasoning  
**Prerequisites:** Must be degree seeking in the College of Education & Human Sciences.  
**Notes:** Open only to middle grades teaching endorsement majors with a mathematics emphasis and/or to elementary education majors who want a mathematics concentration.  
**Description:** How to express mathematical solutions and ideas logically and coherently in both written and oral forms in the context of problem solving. Inductive and deductive logical reasoning skills through problem solving. Present and critique logical arguments in verbal and written forms. Problem topics taken from topics nationally recommended for middle school mathematics.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics

MATH 306 Number Theory and Cryptology for Middle Level Teachers  
**Prerequisites:** Must be degree seeking in the College of Education & Human Sciences.  
**Notes:** MATH 306 is open only to a middle school or elementary grades teaching endorsement program student.  
**Description:** Basic number theory results which are needed to understand the number theoretic RSA cryptography algorithm. Primes, properties of congruences, divisibility tests, linear Diophantine equations, linear congruences, Chinese Remainder Theorem, Wilson’s Theorem, Fermat’s Little Theorem, Euler’s Theorem, and Euler’s phi function. Integers with connections to the middle school curriculum and mathematical reasoning.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics

MATH 309 Introduction to Mathematical Proofs  
**Prerequisites:** A grade of P, C, or better in MATH 107 or MATH 107H.  
**Description:** Basic set theory; elements of logic and types of proofs; induction; study of relations and functions; and cardinality of sets.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics

MATH 310 Introduction to Modern Algebra  
**Prerequisites:** A grade of P, C, or better in MATH 208 or MATH 208H.  
**Description:** Elementary number theory, including induction, the Fundamental Theorem of Arithmetic, and modular arithmetic. Introduction to rings and fields as natural extension of the integers. Particular emphasis on the study of polynomials with coefficients in the rational, real, or complex numbers.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** MATH 350; MATH 407; MATH 408; MATH 417; MATH 430; MATH 450; MATH 452; MATH 471; MATH 809, MATH 409  
**Groups:** Advanced Mathematics Courses
MATH 310H Honors: Introduction to Modern Algebra
Prerequisites: Good Standing in the University Honors Program and a grade of P, C, or better in MATH 208 or MATH 208H
Description: For course description, see MATH 310.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 350; MATH 407; MATH 408; MATH 417; MATH 430; MATH 450; MATH 452; MATH 471; MATH 809, MATH 409
Groups: Advanced Mathematics Courses

MATH 314 Linear Algebra
Prerequisites: A grade of P, C, or better in MATH 107 or MATH 107H
Description: Fundamental concepts of linear algebra, including properties of matrix arithmetic, systems of linear equations, vector spaces, inner products, determinants, eigenvalues and eigenvectors, and diagonalization.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 970; MATH 405; MATH 435; MATH 442; MATH 456; MATH 471; MATH 809, MATH 409; MECH 350; STAT 970
ACE: ACE 3 Math/Stat/Reasoning

MATH 314H Honors: Linear Algebra
Prerequisites: Good Standing in the University Honors Program and a grade of P, C, or better in MATH 107 or MATH 107H
Description: For course description, see MATH 314.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 405; MATH 435; MATH 442; MATH 456; MATH 471; MATH 809, MATH 409; MECH 350
ACE: ACE 3 Math/Stat/Reasoning

MATH 316 Case Studies in Theoretical Ecology
Crosslisted with: BIOS 316, NRES 316
Prerequisites: MATH 106 or higher OR LIFE 121. Parallel registration in BIOS 316L.
Description: Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to field questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 4 Science
Groups: Advanced Mathematics Courses

MATH 322 Advanced Calculus
Crosslisted with: MATH 822
Description: Uniform convergence of sequences and series of functions, Green's theorem, Stokes' theorem, divergence theorem, line integrals, implicit and inverse function theorems, and general coordinate transformations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 456; MECH 812; MECH 939; METR 965
Groups: Advanced Mathematics Courses

MATH 325 Elementary Analysis
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Description: An introduction to mathematical reasoning, construction of proofs, and careful mathematical writing in the context of continuous mathematics and calculus. Topics may include the real number system, limits and continuity, the derivative, integration, and compactness in terms of the real number system.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 425; MATH 430; MATH 450; MATH 452; MATH 471
Groups: Advanced Mathematics Courses

MATH 350 Geometry for High School Teaching
Prerequisites: A grade of P, C, or better in MATH 310 or MATH 310H
Notes: NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.
Description: Modern elementary geometry, plane transformations and applications, the axiomatic approach, Euclidean constructions. Additional topics vary.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 408
Groups: Introductory Mathematics

MATH 398 Special Topics in Mathematics
Prerequisites: Permission.
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 24
Format: LEC
Groups: Seminars, Ind Study, Topics

MATH 399 Independent Study in Mathematics
Prerequisites: Permission.
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 24
Format: IND
Groups: Seminars, Ind Study, Topics
MATH 399H Honors Course  
Prerequisites: Permission.  
Credit Hours: 1-4  
Min credits per semester: 1  
Max credits per semester: 4  
Max credits per degree: 4  
Format: IND  
Groups: Seminars, Ind Study, Topics  

MATH 405 Discrete and Finite Mathematics for High School Teaching  
Prerequisites: A grade of P, C, or better in MATH 314 or MATH 314H  
Notes: Credit is not allowed for both CSCE 235 and MATH 405.  
Description: Designed around a series of projects in which students create mathematical models to examine the mathematics underlying several socially-relevant questions.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses  

MATH 407 Mathematics for High School Teaching I  
Prerequisites: MATH 208 and 310  
Notes: NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.  
Description: Analysis of the connections between college mathematics and high school algebra and precalculus.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses  

MATH 409 Math for High School Teachers II, Using Math to Understand Our World  
Crosslisted with: MATH 809  
Prerequisites: MATH 310, MATH 314, MATH 380/STAT 380  
Notes: Not open to MA or MS students in Mathematics. This course is for students seeking a mathematics major under the Education Option and for students in CEHS who are seeking their secondary mathematics teaching certificate.  
Description: Designed around a series of projects in which students create mathematical models to examine the mathematics underlying several socially-relevant questions.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  

MATH 409 Discrete and Finite Mathematics for High School Teaching  
Prerequisites: A grade of P, C, or better in MATH 314 or MATH 314H  
Notes: Credit is not allowed for both CSCE 235 and MATH 405.  
Description: Designed around a series of projects in which students create mathematical models to examine the mathematics underlying several socially-relevant questions.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses  

MATH 410 Introduction to Math Modeling  
Prerequisites: MATH 314/814 and either MATH 325 or MATH 310  
Description: Topics fundamental to the study of linear transformations on finite and infinite dimensional vector spaces over the real and complex number fields including: subspaces, direct sums, quotient spaces, dual spaces, matrix of a transformation, adjoint map, invariant subspaces, triangularization and diagonalization. Additional topics may include: Riesz Representation theorem, projections, normal operators, spectral theorem, polar decomposition, singular value decomposition, determinant as an n-linear functional, Cayley-Hamilton theorem, nilpotent operators, and Jordan canonical form.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  

MATH 415 Theory of Linear Transformations  
Crosslisted with: MATH 815  
Prerequisites: MATH 314/814 and either MATH 325 or MATH 310  
Description: Topics fundamental to the study of linear transformations on finite and infinite dimensional vector spaces over the real and complex number fields including: subspaces, direct sums, quotient spaces, dual spaces, matrix of a transformation, adjoint map, invariant subspaces, triangularization and diagonalization. Additional topics may include: Riesz Representation theorem, projections, normal operators, spectral theorem, polar decomposition, singular value decomposition, determinant as an n-linear functional, Cayley-Hamilton theorem, nilpotent operators, and Jordan canonical form.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses  

MATH 417 Group Theory  
Prerequisites: A grade of P, C, or better in MATH 310 or MATH 310H  
Description: Elementary group theory, including cyclic, dihedral, and permutation groups; subgroups, cosets, normality, and quotient groups; fundamental isomorphism theorems; the theorems of Cayley, Lagrange, and Cauchy; and if time allows, Sylow’s theorems.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
ACE: ACE 10 Integrated Product  
Groups: Advanced Mathematics Courses  

MATH 423 Complex Analysis  
Crosslisted with: MATH 823  
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H  
Description: Complex numbers, functions of complex variables, analytic functions, complex integration, Cauchy’s integral formulas, Taylor and Laurent series, calculus of residues and contour integration, conformal mappings, harmonic functions. Applications of these concepts in engineering, physical sciences, and mathematics.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses  

MATH 424 Introduction to Partial Differential Equations  
Crosslisted with: MATH 824  
Prerequisites: A grade of P, C, or better in MATH 221 or MATH 221H  
Notes: Not open to MA or MS students in mathematics or statistics.  
Description: Derivation of the heat, wave, and potential equations; separation of variables method of solution; solutions of boundary value problems by use of Fourier series, Fourier transforms, eigenfunction expansions with emphasis on the Bessel and Legendre functions; interpretations of solutions in various physical settings.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: MECH 812  
Groups: Advanced Mathematics Courses
MATH 425 Mathematical Analysis
Prerequisites: A grade of P, C, or better in MATH 325
Description: Real number system, topology of Euclidean space and metric spaces, compactness, sequences, series, convergence and uniform convergence, and continuity and uniform continuity.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 427 Mathematical Methods in the Physical Sciences
Crosslisted with: MATH 827
Prerequisites: A grade of P, C, or better in MATH 221 or MATH 221H
Notes: Not open to mathematics majors. Not open to MA or MS students in mathematics.
Description: Matrix operations, transformations, inverses, orthogonal matrices, rotations in space. Eigenvectors and eigenvalues, diagonalization, applications of diagonalization. Curvilinear coordinate systems, differential operations in curvilinear coordinate systems, Jacobians, changes of variables in multiple integration. Scalar, vector and tensor fields, tensor operations, applications or tensors. Complex function theory, integration by residues, conformal mappings.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 428 Principles of Operations Research
Crosslisted with: MATH 828
Prerequisites: MATH 314; STAT 380 or MECH 321.
Description: Introduction to techniques and applications of operations research. Includes linear programming, queueing theory, decision analysis, network analysis, and simulation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 430 Ordinary Differential Equations
Prerequisites: MATH 221 or 221H; MATH 310 or MATH 310H or MATH 325.
Description: Qualitative behavior of solutions of systems of differential equations, including existence and uniqueness, extendibility, and periodic solutions. The Putzer algorithm, Floquet theory, matrix norms, linearization, stability theory, and period-doubling and chaos.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 432 Linear Optimization
Crosslisted with: MATH 832
Prerequisites: MATH 314 or 314H; MATH 310 or 310H or MATH 325
Description: Mathematical theory of linear optimization, convex sets, simplex algorithm, duality, multiple objective linear programs, formulation of mathematical models.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 433 Nonlinear Optimization
Crosslisted with: MATH 833
Prerequisites: MATH 314/814 and MATH 310 or MATH 325
Description: Mathematical theory of unconstrained and constrained optimization for nonlinear multivariate functions, particularly iterative methods, such as quasi-Newton methods, least squares optimization, and convex programming. Computer implementation of these methods.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 435 Math in the City
Prerequisites: MATH 221 or 221H and MATH 314 or 314H; or MATH 221 or 221H and STAT 380, or MATH 314 or 314H and STAT 380.
Description: A research experience modeling problems of current interest to the local community, businesses, or government.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses

MATH 439 Mathematical Models in Biology
Crosslisted with: MATH 839
Prerequisites: A grade of P, C, or better in MATH 107 or MATH 107H
Notes: Has a small laboratory component.
Description: Discrete and continuous models in ecology, population models, predation, food webs, the spread of infectious diseases, and life histories. Elementary biochemical reaction kinetics; random processes in nature. Use of software for computation and graphics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses
MATH 440 Numerical Analysis I
Crosslisted with: CSCE 440, CSCE 840, MATH 840
Prerequisites: CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, CSCE 155T, or SOFT 160; MATH 107.
Notes: Credit toward the degree may be earned in only one of the following: CSCE/MATH 440/840 and MECH 480/880.
Description: Principles of numerical computing and error analysis covering numerical error, root finding, systems of equations, interpolation, numerical differentiation and integration, and differential equations. Modeling real-world engineering problems on digital computers. Effects of floating point arithmetic.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 942, MATH 942

MATH 441 Approximation of Functions
Crosslisted with: CSCE 441, CSCE 841, MATH 841
Prerequisites: MATH 221/MATH 221H and MATH 314/MATH 314H.
Description: Polynomial interpolation, uniform approximation, orthogonal polynomials, least-first-power approximation, polynomial and spline interpolation, approximation and interpolation by rational functions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 942, MATH 942
Groups: Advanced Mathematics Courses

MATH 442 Methods of Applied Mathematics I
Prerequisites: MATH 221 or 221H, or their equivalents.
Description: Derivation, analysis, and interpretation of mathematical models for problems in the physical and applied sciences. Scaling and dimensional analysis. Asymptotics, including regular and singular perturbation methods and asymptotic expansion of integrals. Calculus of variations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisites: MATH 221 or 221H; MATH 314 or 314H; and MATH 322.

MATH 444 Number Theory
Crosslisted with: MATH 845
Prerequisites: MATH 310 or 310H
Description: Fundamentals of number theory, including congruences, primality tests, factoring methods. Diophantine equations, quadratic reciprocity, continued fractions, and elliptic curves.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 445 Number Theory
Crosslisted with: MATH 845
Prerequisites: MATH 310 or 310H
Description: Fundamentals of number theory, including congruences, primality tests, factoring methods. Diophantine equations, quadratic reciprocity, continued fractions, and elliptic curves.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 447 Numerical Linear Algebra
Crosslisted with: CSCE 447, CSCE 847, MATH 847
Prerequisites: MATH 314
Description: Mathematics and algorithms for numerically stable matrix and linear algebra computations, including solution of linear systems, computation of eigenvalues and eigenvectors, singular value decomposition, and QR decomposition.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 942, MATH 942
Groups: Advanced Mathematics Courses

MATH 450 Combinatorics
Prerequisites: MATH 310 or 310H or 325.
Description: Theory of enumeration and/or existence of arrangements of objects: Pigeonhole principle, inclusion-exclusion, recurrence relations, generating functions, systems of distinct representatives, combinatorial designs and other applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 452 Graph Theory
Prerequisites: MATH 310 or MATH 325
Notes: Selected applications.
Description: Theory of directed and undirected graphs. Trees, circuits, subgraphs, matrix representations, coloring problems, and planar graphs. Methods which can be implemented by computer algorithms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 454 Graph Theory
Prerequisites: MATH 221 or 221H; MATH 314 or 314H; and MATH 322.
Description: Introduction to a selection of topics in modern differential manifolds, vector bundles, vector fields, tensors, differential forms, Stoke's theorem, Riemannian and semi-Riemannian metrics, Lie Groups, connections, singularities. Includes gauge field theory, catastrophe theory, general relativity, fluid flow.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 455 Introduction to Mathematical Logic
Crosslisted with: MATH 865
Description: Semantical and syntactical developments of propositional logic, discussion of several propositional calculi, application of Boolean algebra and related topics, semantics and syntax of first order predicate logic including Godel's completeness theorem, the compactness theorem.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses
MATH 471 Introduction to Topology
Prerequisites: MATH 314 and either MATH 325 or 310
Description: Elementary point-set and geometric topology. Point-set topics include topological spaces, continuous functions, homeomorphisms, connectedness, compactness, quotient spaces. Geometric topology topics include Euler characteristic, classification of surfaces, and other applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

MATH 487 Probability Theory
Crosslisted with: MATH 887
Prerequisites: MATH 314 and one of MATH 309, MATH 310, or MATH 325
Description: Probability, conditional probability, Bayes' theorem, independence, discrete and continuous random variables, density and distribution functions, multivariate distributions, probability and moment generating functions, the central limit theorem, convergence of sequences of random variables, random walks, Poisson processes and applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

MATH 489 Stochastic Processes
Crosslisted with: MATH 889
Prerequisites: MATH 314 and STAT 380 (or STAT 880)
Description: Markov chains, continuous-time Markov processes, the Poisson process, Brownian motion, introduction to stochastic calculus.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses

MATH 495 Seminar
Prerequisites: MATH 208 or 208H; and permission.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Format: LEC
Groups: Seminars, Ind Study, Topics

MATH 496 Seminar in Mathematics
Prerequisites: Permission.
Description: Topics in one or more branches of mathematics.
Credit Hours: 4.00
Max credits per semester: 4
Max credits per degree: 13
Format: LEC
Groups: Seminars, Ind Study, Topics

MATH 497 Reading Course
Prerequisites: Permission.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 4
Format: IND
Groups: Seminars, Ind Study, Topics

PLEASE NOTE
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Mathematics (B.A.)
Mathematics - sTANDARD (B.S.)

Career Information
The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

Transferable Skills
• Apply mathematical and scientific skills to solve real-world problems
• Develop basic techniques of statistical analysis
• Analyze and explain data
• Make predictions using mathematical, statistical, and scientific modeling methods
• Simplify complex information and present it to others
• Examine problems from multiple perspectives
• Use quantitative analysis techniques
• Use qualitative analysis techniques

Jobs of Recent Graduates
• Business Analyst, Sandhills Publishing - Lincoln NE
• Quality Assurance Analyst, Nanonation - Lincoln NE
• Implementation Consultant, Fast Enterprises - Centennial CO
• Data Engineer, Hudl - Lincoln NE
• Website Production Support, Cabela's - Omaha NE
• Programmer/Analyst, Centrix Solutions, Inc. - Lincoln NE
• Math Teacher, Omaha Public Schools - Omaha NE
• Actuary, CNA Insurance - Chicago IL
• Social Insurance Specialist, Social Security - Kansas City MO
• Statistical Analyst, Experian - Lincoln NE
• Mathematics Teacher, Norris School District #16 - Firth NE
• Software Development Engineer, Hudl - Redmond WA
• 2nd Lieutenant, United States Army - Ft. Benning GA
• Account Executive, 93.7 The Ticket - Lincoln NE
• Data & Research Analyst, Mercer - Urbandale IA

Internships
• Data Science Intern, The Hartford Insurance Company - Hartford CT
• Actuarial Intern, Lincoln Financial Group - Omaha NE
• Intern, American Embassy - Berlin, Germany
• Programming Intern, Firespring - Lincoln NE
• Intern, Nebraska Human Resources Institute - Lincoln NE
• Intern, Bureau of Sociological Research - Lincoln NE
• Software Development Intern, Tigerpaw Software - Bellevue NE
• Intern, Tetrad Property Group - Lincoln NE
• Summer Intern, Southwestern - Nationwide
• Intern, Group Actuarial, Ameritas Life Insurance Corp. - Lincoln NE
• Programming Intern, Firespring - Lincoln NE
• Associate Logistics Professional Intern, ConAgra Foods - Omaha NE

Graduate & Professional Schools
• Ph. D., Mathematics, University of Nebraska-Lincoln - Lincoln NE
• Ph.D., Physics, University of Nebraska-Lincoln - Lincoln NE
• Ph.D., Economics, University of Tennessee - Knoxville TN
• Master’s Degree, Computer Science, University of Malaya - Kuala Lumpur ZZ
• Ph.D., Neural Computation, Center for Neural Basis of Cognition - Pittsburgh PA
• Doctor of Physical Therapy, Creighton University - Omaha NE
• Ph.D., Statistics, University of Nebraska-Lincoln - Lincoln NE
• Master’s Degree, System Engineering, University of Pennsylvania - Philadelphia PA
• Master’s Degree, Biostatistics, University of Southern California - Los Angeles CA
• Ph.D., Agricultural & Resource Economics, University of California, Berkeley - Berkley CA
• Master’s Degree, Math Education, UNL - Lincoln NE
• Master’s Degree, Actuarial Science, UNL - Lincoln NE
• Master’s Degree, Physics, Ohio State University - Columbus OH
• Master’s Degree, Atmospheric Science, University of Utah - Salt Lake City UT