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.

Options in the Major
Students majoring in Mathematics have seven different options available on both the Bachelor of Arts or the Bachelor of Science degree to focus their advanced coursework in ways that meet their specific interests and career goals. All students complete a core set of requirements and can determine, in consultation with faculty and their academic advisor, which specific option and degree to follow. The option will be documented on the final transcript.

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

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.

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.

Mathematical Biology Option
Recommended for students interested in a mathematics major and a coherent body of coursework studying areas of biology in a quantitative manner.

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

Mathematics of 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.

Statistics and Data Science Option
Recommended for students interested in a mathematics major and studying data and statistical analysis using a coherent body of coursework in computer science and statistics.

Learning Outcomes
Graduates with a major in mathematics will:

1. Reason quantitatively using numeric, algebraic, and analytic methods.
2. Understand, analyze, create, and discover mathematical arguments organized by means of definitions, results, proofs, and examples.
3. Apply critical and precise mathematical thinking to model, formulate, and solve problems in interdisciplinary or practical settings.
4. Communicate mathematical ideas, both in writing and orally, to varied audiences, including formal reasoning and applications of mathematics.

Graduates with the standard option will also be able to:

• Demonstrate an understanding of a breadth of theoretical and applicable knowledge in selected branches of mathematics of the student's choice.

Graduates with the discrete mathematics and cryptography option will also be able to:

• Develop fluency in the techniques of discrete mathematics, including graph theory and combinatorics. Apply these and other mathematical techniques to design and implement secure cryptographic protocols.

Graduates with the education option will also be able to:

• Build foundational content knowledge relevant to secondary mathematics education. Develop skills to effectively disseminate this knowledge to students.

Graduates with the mathematical biology option will also be able to:

• Apply mathematical modeling techniques to biological systems, such as population dynamics, epidemiology, genetics, and biochemical reaction networks. Analyze data from experiments and make biological inferences using mathematical arguments.

Graduates with the mathematical finance option will also be able to:

• Apply tools from probability, stochastic analysis, and other mathematical fields to financial decision-making, including capital budgeting and risk analysis.

Graduates with the mathematics of physical phenomena option will also be able to:

• Apply mathematical techniques to model, analyze, and solve problems arising from physical phenomena, such as motion, waves, climate, geodynamics, electromagnetism, and thermodynamics.

Graduates with the statistics and data science option will also be able to:

• Understand the principles of mathematical and statistical modeling and their computational applications to large data sets. Apply mathematical, statistical, and computational techniques to make predictions and inform decision-making using data.

Academic and Career Advising

Academic and Career Advising Center
Not sure where to go or who to ask? The Advising Center team in 107 Oldfather Hall can help. The Academic and Career Advising Center is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who
are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representatives.

CAS Career Coaches are available by appointment (in-person or Zoom) and located in the CAS Academic and Career Advising Center, 107 Oldfather Hall. They help students explore majors and minors, gain experience, and develop a plan for life after graduation.

**Assigned Academic Advisors**

Academic advisors are critical resources dedicated to students' academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline specific expertise. They are available for appointments (in-person or Zoom) and through weekly virtual drop-ins. Assigned advisors are listed in MyRED (https://its.unl.edu/myunl/) and their offices may be located in or near the department of the major for which they advise.

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 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, visit https://cas.unl.edu/major-advisors/), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, casadvising@unl.edu.

**Career Coaching**

The College believes that Academics + Experience = Opportunities and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value.

Graduates are prepared to effectively contribute professionally and personally with a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather Hall, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

**ACE Requirements**

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE (http://ace.unl.edu) website (http://ace.unl.edu) for the most current list of certified courses.

**ACE Student Learning Outcomes**

<table>
<thead>
<tr>
<th>ACE 1</th>
<th>Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE 2</td>
<td>Demonstrate competence in communication skills.</td>
</tr>
<tr>
<td>ACE 3</td>
<td>Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.</td>
</tr>
<tr>
<td>ACE 4</td>
<td>Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.</td>
</tr>
<tr>
<td>ACE 5</td>
<td>Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.</td>
</tr>
<tr>
<td>ACE 6</td>
<td>Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.</td>
</tr>
<tr>
<td>ACE 7</td>
<td>Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.</td>
</tr>
<tr>
<td>ACE 8</td>
<td>Use knowledge, theories, and analysis to explain ethical principles and their importance in society.</td>
</tr>
<tr>
<td>ACE 9</td>
<td>Exhibit global awareness or knowledge of human diversity through analysis of an issue.</td>
</tr>
<tr>
<td>ACE 10</td>
<td>Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.</td>
</tr>
</tbody>
</table>

**College Degree Requirements**

**College Distribution Requirements – BA and BS**

The College of Arts and Sciences distribution requirements are common to both the bachelor of arts and bachelor of science degrees and are designed to ensure a range of courses. 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, and no course can be used to fulfill 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, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Internship (395 or 495), independent study or readings (396 or 496), research (398 or 498), and thesis (399, 399H, 499, or 499H) will not satisfy distribution requirements.
- Other courses with a 9 in the middle number (ex. PSYC 292) will not satisfy distribution requirements unless approved by an advisor.
• Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the lead department.

**College Distribution Requirements**

**CDR: Written Communication**

3

Select from courses approved for ACE outcome 1.

**CDR: Natural, Physical, and Mathematical Sciences**

3-4

Select a course from ASTR, BIOS, CHEM, GEOL, LIFE, METR, MATH, PHYS, or ANTH 242, GEOG 155, GEOG 181, POLS 250, or PSYC 273.

**CDR: Laboratory**

0-1

Laboratory courses may be embedded in a 4-5 credit course used in CDR Natural, Physical, and Mathematical Science (example GEOG 155), or stand alone (example LIFE 120L).

**CDR: Humanities**

3

Select a course from ARAB, CHIN, CLAS, CZEC, ENGL, FREN, GERM, GREK, HIST, JAPN, LATN, PHIL, RELG, RUSS, or SPAN.

**CDR: Social Science**

3

Select from courses approved for ACE outcome 2.

**CDR: Human Diversity in U.S. Communities**

0-3

Select from the following approved courses also listed in your degree audit: ANTH 130, ANTH 412, ANTH 473, ARAB 313, COMM 311, COMM 364, COMM 465, ENGL 212, ENGL 245N, ENGL 312, ENGL 345D, ENGL 345N, ENGL 346, ENGL 376, ENGL 390, ENGL 445, ETHN 100, ETHN 201, ETHN 202, ETHN 205, FILM 344, GEOG 271, GEOG 403, GLST 350, HIST 115, HIST 246, HIST 251, HIST 323, HIST 340, HIST 351, HIST 356, HIST 357, HIST 402, PHIL 105, PHIL 106, PHIL 218, PHIL 323, PHIL 325, POLS 333, POLS 338, POLS 347, PSYC 310, PSYC 330, PSYC 421, PSYC 425, RELG 134, RELG 226, RELG 227, RELG 313, SOCI 101, SOCI 180, SOCI 200, SOCI 217, SPAN 206, SPAN 486, WMNS 101, WMNS 201, WMNS 202, WMNS 210, WMNS 356

**CDR: Language**

0-16

Fulfilled by the completion of the 4th level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, RUSS, SLPA, or SPAN.

Credit Hours Subtotal: 12-33

1 Excluded courses: BIOC 101, BIOS 100, CHEM 101, Mbio 101, PHYS 201, MATH 100A, MATH 101, MATH 102, MATH 103.

2 ANTH 242L, ASTR 224, BIOS 101L, BIOS 110L, BIOS 111, BIOS 213L, BIOE 214, CHEM 105L, CHEM 106L, CHEM 109L, CHEM 110L, CHEM 113L, GEOG 155, GEOG 101, GEOG 103, LIFE 120L, LIFE 121L, METR 100, PHYS 141, PHYS 142, PHYS 153, PHYS 221, or PHYS 222.

3 ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, RUSS, and SPAN courses must be numbered 300 or above. ENGL courses must be ENGL 170, ENGL 180, or ENGL 200 level and above. Excluded courses: CLAS 116, ENGL 254, ENGL 300, ENGL 354, SPAN 300A, SPAN 303, and SPAN 304.

4 Excluded courses: ANTH 242/ANTH 242L, GEOG 155, GIST 111, GIST 311, POLS 101, POLS 250, PSYC 100, PSYC 273.

5 ARAB 202, CHIN 202, CZEC 202, FREN 202 or FREN 210, GERM 202, GREK 301 and GREK 302, JAPN 201 and JAPN 202, LATN 301 and LATN 302, RUSS 202, SLPA 202, or SPAN 202 or SPAN 210.

**Language Requirement - BA and BS**

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

**Experiential Learning Requirement - BA and BS**

All undergraduates in the College of Arts and Sciences must complete an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning.

**Scientific Base – BS Only**

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences from disciplines within the College of Arts and Sciences or required in its majors: ACTS, ASTR, BIOC, BIOS, CHEM, CSCE, GEOL, LIFE, METR, MATH, PHYS, STAT or ANTH 242 , ANTH 242L, ANTH 341, ANTH 385, ANTH 386, ANTH 389, ANTH 416, ANTH 422, ANTH 430, ANTH 442, ANTH 443, ANTH 444, ANTH 448, ANTH 473, ANTH 484, ANTH 487D, ENV 201, GEOG 155, GEOG 181, GEOG 217, GEOG 281, GEOG 308, GEOG 317, GEOG 408, GEOG 417, GEOG 418, GEOG 419, GEOG 421, GEOG 422, GEOG 425, GEOG 427, GEOG 432, GEOG 444, GEOG 461, GEOG 467, PHIL 211, POLS 250, PSYC 273, PSYC 368, PSYC 370, PSYC 450, PSYC 451, PSYC 456, PSYC 458, PSYC 460, PSYC 461, PSYC 463, PSYC 464, or PSYC 465.

Excluded courses include: BIOC 101, BIOS 100, CHEM 101, MATH 100A, MATH 101, MATH 102, MATH 103, Mbio 101, PHYS 201 as well as any course numbered 395, 495, 399, 399H, 499, or 499H.

Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the College of Arts and Sciences. See your assigned academic advisor to start the approval process.

**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 cumulative 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 grades from other domestic institutions except for UNO and UNK. All National or International exchange courses must be approved by the College of Arts and Sciences. A cumulative grade point average of at least 2.0 is required.
Pass/No Pass Privilege
University policy for the Pass/No Pass (P/N) privilege:
- Neither the P nor the N grade factor into your GPA.
- 'P' is interpreted to mean a grade of C or above. A grade of C- or lower results in a "N".
- A change to or from a Pass/No Pass may be made until mid-term (1/2 of the course - see the academic calendar for specific dates per term).
- The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University policy governing the grading options.
- Changing to or from the Pass/No Pass grading option requires using MyRED, or processing a Schedule Adjustment Form.
- For undergraduates, the University maximum of 24 'Pass' credit hours and/or college and department limits will apply. These limits do not include courses offered on a 'Pass/No Pass' basis only. Consult your advisor or the Undergraduate Catalog (https://catalog.unl.edu/undergraduate/) for restrictions on the number of 'Pass' hours you can apply toward your degree.
- The 'Pass/No Pass' grading option cannot be used for the removal of 'C-', 'D+', 'D', 'D-', or 'F' grade factors.

NOTE: See Course Repeats (https://registrar.unl.edu/academic-standards/course-repeats/)

College of Arts and Sciences policy on the Pass/No Pass (P/N) privilege:
- Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences majors and minors do not permit any courses graded Pass/No Pass to apply, or limit them to no more than 6 hours. Students should refer to the major section of the catalog for clarification.
- Departments may specify that certain courses of theirs can be taken on a P/N-only or on a graded-only basis.

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 with 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 the University of Nebraska–Lincoln.

Residency Requirement
The term "Residency" refers to courses taken at UNL. Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska–Lincoln. Students must complete at least 18 hours of their major coursework, and 15 of the 30 hours required at the 300 or 400 level, at UNL.

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 the University of Nebraska–Lincoln. 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 the University of Nebraska–Lincoln 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.

Transfer Students: Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska-Lincoln within 1 calendar year from their last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the timeframe allowable for that catalog year.

Major Requirements
Complete the core requirements and the requirements of one option.

Core Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<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>Credit Hours Subtotal:</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

Option Courses
Select and complete the specific requirements for one of seven options described below to complete the major.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>or STAT 380</td>
<td>Statistics and Applications</td>
</tr>
<tr>
<td>MATH 310</td>
<td>Introduction to Modern Algebra</td>
</tr>
<tr>
<td>MATH 325</td>
<td>Elementary Analysis</td>
</tr>
<tr>
<td>Credit Hours Subtotal:</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit Hours Subtotal:</td>
<td></td>
</tr>
</tbody>
</table>

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

1 The following courses do not apply to this requirement: MATH 300, MATH 301, MATH 302, MATH 309, MATH 391, MATH 399, MATH 399H, MATH 407, MATH 408, MATH 493, or MATH 494.

Discrete Mathematics and Cryptography Option

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
<td>3-4</td>
</tr>
<tr>
<td>or MATH 221</td>
<td>Differential Equations</td>
<td></td>
</tr>
<tr>
<td>or STAT 380</td>
<td>Statistics and Applications</td>
<td></td>
</tr>
<tr>
<td>MATH 309</td>
<td>Introduction to Mathematical Proofs</td>
<td>3</td>
</tr>
<tr>
<td>MATH 310</td>
<td>Introduction to Modern Algebra</td>
<td>3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 9-10

Additional Mathematics Courses

Select one course from the following:

- 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 MATH courses at the 400 level.

Credit Hours Subtotal: 6

Computer Science Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCE 155T</td>
<td>Computer Science I: Informatics Focus</td>
<td>3-4</td>
</tr>
<tr>
<td>or CSCE 155A</td>
<td>Computer Science I</td>
<td></td>
</tr>
<tr>
<td>or CSCE 155E</td>
<td>Computer Science I: Systems Engineering Focus</td>
<td></td>
</tr>
<tr>
<td>or CSCE 155H</td>
<td>Honors: Computer Science I</td>
<td></td>
</tr>
<tr>
<td>or CSCE 155N</td>
<td>Computer Science I: Engineering and Science Focus</td>
<td></td>
</tr>
<tr>
<td>or CSCE 183H</td>
<td>Honors: Computer Problem Solving Essentials</td>
<td></td>
</tr>
</tbody>
</table>

Select two courses from the following:

- 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: 12-14

Total Credit Hours 30-33

1 The following courses do not apply to this requirement: MATH 493 and MATH 494.

Education Option

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 309</td>
<td>Introduction to Mathematical Proofs</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 310</td>
<td>Introduction to Modern Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 325</td>
<td>Elementary Analysis</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>MATH 412</td>
<td>Modern Geometry</td>
<td>3</td>
</tr>
<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td>3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 22

Additional Courses

Select one additional 400-level MATH

Credit Hours Subtotal: 3

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

1 The following courses do not apply to this requirement: MATH 493 and MATH 494.

Mathematical Biology Option

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 221</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 309</td>
<td>Introduction to Mathematical Proofs</td>
<td>3</td>
</tr>
<tr>
<td>MATH 325</td>
<td>Elementary Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 439</td>
<td>Mathematical Biology</td>
<td>3</td>
</tr>
<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td>3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 15

Additional Mathematics Courses

Select two additional advanced MATH courses at the 400 level.

Credit Hours Subtotal: 6

Biological Sciences Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIFE 120</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; LIFE 120L</td>
<td>and Fundamentals of Biology I laboratory</td>
<td></td>
</tr>
<tr>
<td>LIFE 121</td>
<td>Fundamentals of Biology II</td>
<td>4</td>
</tr>
<tr>
<td>&amp; LIFE 121L</td>
<td>and Fundamentals of Biology II laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the following sequences:

- BIOS 206 General Genetics
- & BIOS 337 and Applications of Bioinformatics
- BIOS 206 General Genetics
- & BIOS 426 and Systems Biology
- BIOS 206 General Genetics
- & BIOS 427 and Practical Bioinformatics Laboratory
Mathematics

BIOS 207  Ecology and Evolution
& BIOS 452  and Field Epidemiology

BIOS 207  Ecology and Evolution
& BIOS 453  and Predator Ecology

Credit Hours Subtotal: 15-16

Total Credit Hours 36-37

1 The following courses do not apply to this requirement: MATH 407, MATH 408, MATH 493, and MATH 494.

Mathematical Finance Option

Required Courses

MATH 208  Calculus III  4
MATH 221  Differential Equations  3
STAT 380  Statistics and Applications  3
MATH 487  Probability Theory  3-4
or STAT 462  Introduction to Mathematical Statistics I: Distribution Theory

MATH 489  Stochastic Processes  3

Credit Hours Subtotal: 16-17

Additional Courses

Select two courses from the following:  6
MATH 309  Introduction to Mathematical Proofs
MATH 310  Introduction to Modern Algebra
MATH 325  Elementary Analysis
And, one additional advanced MATH course at the 400 level.  3

Credit Hours Subtotal: 9

Actuarial Science and Finance Courses

ACTS 440  Interest Theory  3
FINA 367  Fixed Income Investments  3
FINA 467  Options, Futures and Derivative Securities  3

Credit Hours Subtotal: 9

Total Credit Hours 34-35

1 The following courses do not apply to this requirement: MATH 407, MATH 408, MATH 493, and MATH 494.

Mathematics of Physical Phenomena Option

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 MATH courses at the 400 level.  6

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 physics, meteorology, geology, or engineering:

ECEN 215  Electronics and Circuits I
& ECEN 216  and Electronics and Circuits II
& ECEN 304  and Signals and Systems I
& ECEN 462  and Communication Systems

ECEN 215  Electronics and Circuits I
& ECEN 216  and Electronics and Circuits II
& ECEN 304  and Signals and Systems I
& ECEN 463  and Digital Signal Processing

ECEN 215  Electronics and Circuits I
& ECEN 306  and Electromagnetic Field Theory
& ECEN 408  and Engineering Electromagnetics

GEOL 101  Dynamic Earth
& GEOL 441  and Geophysics
& GEOL 372  and Water & Earth Connections

GEOL 106  Environmental Geology
& GEOL 441  and Geophysics
& GEOL 372  and Water & Earth Connections

MECH 223  Engineering Statics
& MECH 310  and Fluid Mechanics
& MECH 373  and Engineering Dynamics

MECH 223  Engineering Statics
& MECH 325  and Mechanics of Elastic Bodies
& MECH 451  and Introduction to Finite Element Analysis

MECH 223  Engineering Statics
& MECH 350  and Introduction to Dynamics and Control
& MECH 373  of Engineering Systems
and Engineering Dynamics

MECH 223  Engineering Statics
& MECH 373  and Engineering Dynamics
& MECH 449  and Advanced Dynamics

MECH 223  Engineering Statics
& MECH 373  and Engineering Dynamics
& MECH 451  and Introduction to Finite Element Analysis

MECH 223  Engineering Statics
& MECH 373  and Engineering Dynamics
& MECH 475  and Introduction to Mechanical Vibrations

METR 100  Weather and Climate
& METR 205  and Introduction to Atmospheric Science
& METR 223  and Atmospheric Thermodynamics
& METR 311  and Dynamic Meteorology I

METR 100  Weather and Climate
& METR 205  and Introduction to Atmospheric Science
& METR 223  and Atmospheric Thermodynamics
& METR 323  and Physical Meteorology

METR 100  Weather and Climate
& GEOL 441  and Geophysics
& GEOL 372  and Water & Earth Connections

PHYS 213  General Physics III
& ECEN 420  and Plasma Processing of
& ECEN 421  Semiconductors
and Principles of Semiconductor Materials
and Devices I

PHYS 213  General Physics III
& PHYS 311  and Mechanics

PHYS 213  General Physics III
& PHYS 431  and Thermal Physics
PHYS 213 & PHYS 451
General Physics III and Electromagnetic Theory

PHYS 311 & PHYS 401
Mechanics and Computational Physics

Credit Hours Subtotal: 6-16

Total Credit Hours: 33-43

\[ \text{The following courses do not apply to this requirement: MATH 407, MATH 408, MATH 493, and MATH 494.} \]

**Statistics and Data Science Option**

**Required Courses**
- MATH 208 Calculus III 4
- MATH 309 Introduction to Mathematical Proofs 3
- MATH 310 Introduction to Modern Algebra or MATH 325 Elementary Analysis 3
- STAT 380 Statistics and Applications 3

Credit Hours Subtotal: 13

**Additional Mathematics Courses**
Select one of the following MATH courses:
- MATH 428 Principles of Operations Research 3
- MATH 433 Nonlinear Optimization
- MATH 440 Numerical Analysis I
- MATH 487 Probability Theory
- MATH 489 Stochastic Processes

Select one additional advanced MATH course at the 400 level.

Credit Hours Subtotal: 6

**Additional Statistics Courses**
Select two additional STAT courses at the 300 or 400 level.

Credit Hours Subtotal: 6

**Computer Science Courses**
- CSCE 155T Computer Science I: Informatics Focus 3
  - or CSCE 155A Computer Science I
  - 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 183H / Honors: Computer Problem Solving Essentials
  - RAIK 183H
- CSCE 311 Data Structures and Algorithms for Informatics 3
  - or CSCE 310 Data Structures and Algorithms
  - or SOFT 260H / Honors: Software Engineering III
  - RAIK 283H

Select two courses from one of the following sets of courses: 6

**Set 1**
- CSCE 421 Foundations of Constraint Processing
- CSCE 439 Robotics: Algorithms and Applications
- CSCE 370H / RAIK 370H Honors: Data and Models II: Data Science Fundamentals
- CSCE 474 Introduction to Data Mining
- CSCE 476 Introduction to Artificial Intelligence
- CSCE 478 Introduction to Machine Learning
- CSCE 479 Introduction to Deep Learning

Credit Hours Subtotal: 12-13

**Additional MATH Courses**
Select four additional MATH courses from the following:
- MATH 208 Calculus III
- MATH 221 Differential Equations
- MATH 309 Introduction to Mathematical Proofs
- MATH 310 Introduction to Modern Algebra

Credit Hours Subtotal: 12
MATH 314 Linear Algebra
MATH 325 Elementary Analysis
STAT 380 Statistics and Applications
400-level MATH courses 1

Credit Hours Subtotal: 12-13

Total Credit Hours 21-22

1 The following 400-level courses cannot be used to fulfill the minor requirements: MATH 407, MATH 408, MATH 493, and MATH 494.

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.

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 MATH 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 advisor.

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
Grading Option: Graded with Option
Prerequisite for: MATH 101, MATH 103
Course and Laboratory Fee: $10

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, graphs, polynomial and rational functions, exponential and logarithmic functions, systems of equations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: AGST 109; CHEM 105A; CHEM 113A; CHME 204; CRIM 300; MATH 102; MATH 104; METR 100; METR 140
Course and Laboratory Fee: $10

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, MATH 106, MATH 107, or MATH 208) may not earn credit for this course.
Description: Trigonometric functions, identities, trigonometric equations, solution of triangles, inverse trigonometric functions and graphs. Applications of trigonometry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: AGST 109; CHEM 105A; CHME 204; CRIM 300; MATH 102; MATH 104; METR 100; METR 140
Course and Laboratory Fee: $10

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
Grading Option: Graded with Option
Prerequisite for: AGST 109; CHEM 105A; CHEM 109A; CHEM 113A; CHME 204; CRIM 300; CSCE 155A; CSCE 155E; ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; GEOL 200; MATH 104; MATH 106; METR 100; METR 140; PHYS 141; PHYS 141H; PHYS 151; PLAS 361, GEOL 361, NRES 361, SOIL 361; PLAS 458, AGRO 858, NRES 458, NRES 858, SOIL 458; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472
Course and Laboratory Fee: $10
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.
Notes: Credit for both MATH 104 and 106 is not allowed; students with previous credit in any version of MATH 106, MATH 107, or MATH 208 may not earn credit for this course.
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

Grading Option: Graded with Option
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AREN 211; AREN 211; ASTR 204; BI OC 440; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 244; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 109A; CHEM 114; CHME 202; CHME 212; CHME 331; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156; ECEN 156; ECEN 156; ECEN 244; ECON 244; ECON 311A; ECON 311B; ECON 312A; ECON 312B; FDST 363, AGST 363; FINA 361; FINA 361A; FINA 361H; PHY S 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PLAS 361, GEOL 361, NRES 361, SOIL 361; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Course and Laboratory Fee: $10

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 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

Grading Option: Graded with Option
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACCT 308; ACCT 309; ACCT 313; AGST 333, CNST 305; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 355; CHEM 109A; CHME 202; CHME 212; CHME 331; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156; ECEN 156; ECEN 156; ECEN 156; ECEN 244; ECON 244; ECON 311A; ECON 311B; ECON 312A; ECON 312B; FDST 363, AGST 363; FINA 361; FINA 361A; FINA 361H; PHY S 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PLAS 361, GEOL 361, NRES 361, SOIL 361; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Course and Laboratory Fee: $10

MATH 107 Calculus II
Prerequisites: A grade of P,C or better in MATH 106.
Description: Integration theory; techniques of integration; applications of definite integrals; sequences and series; convergence of series; power series; Taylor series and their applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Offered: FALL/SPR
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AREN 211; ASTR 204; BI OC 440; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 244; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 109A; CHEM 114; CHME 202; CHME 212; CHME 331; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156; ECEN 156; ECEN 156; ECEN 244; ECON 244; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENV 210; FINA 361; FINA 361A; FINA 361H; PHY S 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PHYS 212H; PLAS 361, GEOL 361, NRES 361, SOIL 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Course and Laboratory Fee: $10

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
Grading Option: Graded with Option
Offered: FALL/SPR
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; AREN 211; AREN 211; ASTR 204; BI OC 440; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 244; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 109A; CHEM 114; CHME 202; CHME 212; CHME 331; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156; ECEN 156; ECEN 156; ECEN 244; ECON 244; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENV 210; FINA 361; FINA 361A; FINA 361H; PHY S 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PHYS 212H; PLAS 361, GEOL 361, NRES 361, SOIL 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Course and Laboratory Fee: $10
MATH 107R Analytic Geometry and Calculus II
Prerequisites: A grade of P, C or better in MATH 106.
Notes: Open only to students who previously completed the 5 credit hour MATH 107 at UNL and wish to improve their grade.
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
Grading Option: Graded with Option
Prerequisite for: ABUS 341, MRKT 341; ASTR 204; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; CHME 114; CHME 332; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; ECEN 211; ECON 215; ECON 311A; ECON 311B; ECON 312A; ECON 312B; FINA 361; FINA 361H; MATH 107; MATH 208; MATH 221; MATH 221H; MATH 314; MECH 223; METR 100; METR 140; MGNT 301; MGNT 301H; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211H; PHYS 212; PLAS 361, GEO 361, NRES 361, SOIL 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
MATH 189H University Honors Seminar
Prerequisites: Good standing in the University Honors Program or by invitation; placement score on the Math Placement Examination (MPE) at the MATH 104-level or above.
Notes: Topics vary. A University Honors Seminar 189H is required of all students in the University Honors Program.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: METR 100; METR 140
ACE: ACE 3 Math/Stat/Reasoning
MATH 191 Special Topics in Mathematics
Description: Topics vary.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Graded with Option
Prerequisite for: METR 100; METR 140
MATH 203 Contemporary Mathematics
Notes: Credit toward the degree cannot be earned in both MATH 203 and 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
Grading Option: Graded with Option
ACE: ACE 3 Math/Stat/Reasoning

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
Grading Option: Graded with Option
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACTS 445; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; CHME 114; CHME 332; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; ECEN 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENV 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MECH 223H; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; MGNT 301; MGNT 301H; MGNT 301H; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 262; STAT 462
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
Grading Option: Graded with Option
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACTS 445; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; CHME 114; CHME 332; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; ECEN 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENV 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MECH 223H; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; MGNT 301; MGNT 301H; MGNT 301H; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 213H; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 262; STAT 462
ACE: ACE 3 Math/Stat/Reasoning

MATH 209H 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
Grading Option: Graded with Option
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACTS 445; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; CHME 114; CHME 332; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; ECEN 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENV 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MECH 223H; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; MGNT 301; MGNT 301H; MGNT 301H; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 213H; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 262; STAT 462
ACE: ACE 3 Math/Stat/Reasoning

ACE: ACE 3 Math/Stat/Reasoning
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
Grading Option: Graded with Option
Prerequisite for: AGEN 303, BSEN 303; AGEN 344, BSEN 344; AGEN 350, BSEN 350; AGEN 953; AGEN 957; BSEN 957; CIVE 957; GEOL 957; BSEN 260, AGEN 260; BSEN 311; AGEN 931; BSEN 943; BSEN 954; CHME 312; CHME 815; CHME 825; CHME 835; CIVE 310; CIVE 310H; ECEN 213; ECEN 216; ECEN 304; ECEN 306; ECEN 328; ENGR 410; MATH 430; MATH 435; MECH 310; MECH 310H; MECH 318; MECH 330; MECH 381; MECH 449; MECH 849; MECH 454, MECH 854; MECH 480, MECH 880; MECH 810; MECH 881; MECH 925; MECH 933; MECH 936; MECH 938; MECH 939; METR 312; PHYS 311; PHYS 422, PHYS 822, ECEN 422, ECEN 822
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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: AGEN 303, BSEN 303; AGEN 344, BSEN 344; AGEN 350, BSEN 350; AGEN 953; AGEN 957; BSEN 957; CIVE 957; GEOL 957; BSEN 260, AGEN 260; BSEN 311; AGEN 931; BSEN 943; BSEN 954; CHME 312; CHME 815; CHME 825; CHME 835; CIVE 310; CIVE 310H; ECEN 213; ECEN 216; ECEN 304; ECEN 306; ECEN 328; ENGR 410; MATH 430; MATH 435; MECH 310; MECH 310H; MECH 318; MECH 330; MECH 381; MECH 449; MECH 849; MECH 454, MECH 854; MECH 480, MECH 880; MECH 810; MECH 881; MECH 925; MECH 933; MECH 936; MECH 938; MECH 939; METR 312; PHYS 311; PHYS 422, PHYS 822, ECEN 422, ECEN 822
MATH 300 Mathematics Matters
Prerequisites: TEAC 308 or TEAC 416D or parallel.
Notes: Admission to the College of Education & Human Sciences and removal of math entrance deficiencies is required. 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
Grading Option: Graded with Option
Prerequisite for: MATH 221H Honors:Differential Equations
Prerequisite for: 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 make the mathematics more accessible.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
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: 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
Grading Option: Graded with Option
MATH 309 Introduction to Mathematical Proofs
Prerequisites: A grade of P, C, or better in MATH 107 or MATH 107H
Description: General 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
Grading Option: Graded with Option
Prerequisite for: MATH 325; MATH 398; MATH 412; MATH 430; MATH 450; MATH 452; MATH 460; MATH 471
MATH 310 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
Grading Option: Graded with Option
Prerequisite for: CSCE 970; MATH 430; MATH 435; MECH 350; STAT 301; STAT 871
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
Grading Option: Graded with Option
Prerequisite for: MATH 430; MATH 435; MECH 350; STAT 871

MATH 315 Linear Algebra for Data Science
Prerequisites: A grade of P, C, or better in MATH 104 or MATH 107/107H
Notes: Credit cannot be earned for both MATH 314/314H and MATH 315.
MATH 315 cannot be used toward a major in Mathematics.
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, with emphasis in data science applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MATH 325 Elementary Analysis
Prerequisites: A grade of P, C, or better in MATH 309 or MATH 310.
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
Grading Option: Graded with Option

MATH 391 Special Topics in Mathematics
Prerequisites: Permission.
Description: Topics vary.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option

MATH 394 Independent Study in Mathematics
Prerequisites: Permission
Description: Independent reading or research directed by a faculty member.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option

MATH 398 Research Experience in Mathematics
Prerequisites: MATH 309, MATH 310, or MATH 325
Description: An introduction to open, unsolved problems in pure and applied mathematics. Development of foundational understanding necessary to approach open problems. Engagement in data collection, forming hypotheses, problem solving, and other creative aspects of mathematical research. Discussion about how to find and read existing mathematical research papers, and emphasis on effective mathematical writing and communication.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option
Experiential Learning: Research

MATH 399 Undergraduate Thesis
Prerequisites: Permission.
Description: Independent research leading to an undergraduate thesis.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option

MATH 399H Honors Undergraduate Thesis
Prerequisites: Permission.
Description: Independent research and writing leading to an undergraduate thesis.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option

MATH 407 Mathematics for High School Teaching I
Crosslisted with: MATH 807
Prerequisites: MATH 208/208H and MATH 309 or MATH 310.
Notes: Open only MATH majors with a declared Education option.
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
Grading Option: Graded with Option
Offered: SPRING

MATH 408 Mathematics for High School Teaching II
Crosslisted with: MATH 808
Prerequisites: MATH 412 and MATH 309 or MATH 310.
Notes: Open only MATH majors with a declared Education option.
Description: Analysis of the connections between college mathematics and high school algebra and geometry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL
MATH 412 Modern Geometry
Prerequisites: MATH 309, MATH 310, or MATH 325
Description: Modern geometry from multiple points of view, such as axiomatic, transformational, or analytic. Applications of geometry. Additional topics vary, but can include projective geometry, hyperbolic geometry, or Euclidean constructions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL

MATH 415 Theory of Linear Transformations
Crosslisted with: MATH 815
Prerequisites: MATH 314/814; and MATH 309, MATH 310, or MATH 325.
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
Grading Option: Graded with Option

MATH 417 Group Theory
Prerequisites: A grade of P, C, or better in MATH 310
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
Grading Option: Graded with Option

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
Grading Option: Graded with Option

MATH 424 Introduction to Partial Differential Equations
Crosslisted with: MATH 824
Prerequisites: A grade of P, C, or better in MATH 208/208H and MATH 221/221H.
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
Grading Option: Graded with Option
Prerequisite for: MECH 812

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
Grading Option: Graded with Option

MATH 428 Principles of Operations Research
Crosslisted with: MATH 828
Prerequisites: MATH 314 or MATH 314H; and RAIK 270H, 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
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

MATH 430 Ordinary Differential Equations
Prerequisites: MATH 221 or MATH 221H; MATH 314 or MATH 314H; MATH 309, MATH 310, 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
Grading Option: Graded with Option

MATH 433 Nonlinear Optimization
Crosslisted with: MATH 833
Prerequisites: MATH 208/208H; MATH 314/314H; and MATH 309, 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
Grading Option: Graded with Option
Offered: SPRING
MATH 435 Math in the City
Prerequisites: Two of MATH 221, MATH 221H, MATH 314, MATH 314H, RAIR 270H, 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
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product
Experiential Learning: Case/Project-Based Learning

MATH 439 Mathematical Biology
Crosslisted with: MATH 839
Prerequisites: MATH 221/221H & MATH 314/314H.
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
Grading Option: Graded with Option

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
Grading Option: Graded with Option

MATH 445 Number Theory
Crosslisted with: MATH 845
Prerequisites: MATH 310.
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
Grading Option: Graded with Option

MATH 447 Numerical Methods for Applied Math
Crosslisted with: MATH 847
Prerequisites: MATH 208/208H, MATH 221/221H & MATH 314/314H
Description: Numerical methods for approximate solutions of applied mathematics problems. Topics typically considered include numerical solution of linear systems of equations, approximation of eigenvalues and eigenvectors, numerical solution of nonlinear systems of equations, and numerical solution of initial value problems for ordinary differential equations. Given time, mathematical applications in optimization, machine learning, or data science may be considered.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: CSCE 942

MATH 450 Combinatorics
Prerequisites: MATH 309, MATH 310, or MATH 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
Grading Option: Graded with Option

MATH 452 Graph Theory
Prerequisites: MATH 309, MATH 310, or MATH 325.
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
Grading Option: Graded with Option

MATH 460 History of Mathematics
Prerequisites: MATH 309, MATH 310, or MATH 325
Description: An overview of the development of modern mathematics, particularly the development of algebra, geometry, and calculus. Case studies, such as solvability of polynomial equations, the role of the parallel postulate in geometry, the development of analytic geometry, or additional topics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL

MATH 471 Introduction to Topology
Prerequisites: MATH 309, MATH 310, or MATH 325
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
Grading Option: Graded with Option
MATH 487 Probability Theory
Crosslisted with: MATH 887
Prerequisites: MATH 314 or MATH 314H; and 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
Grading Option: Graded with Option

MATH 489 Stochastic Processes
Crosslisted with: MATH 889
Prerequisites: MATH 314 or MATH 314H; and STAT 380 or RAIK 270H.
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
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

MATH 493 Seminar in Mathematics
Crosslisted with: MATH 893
Prerequisites: Permission.
Description: Topics in one or more branches of mathematics.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 8
Grading Option: Graded with Option

MATH 494 Independent Study in Mathematics
Prerequisites: Permission.
Description: Directed reading or research with a faculty member.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

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
- High School Math Teacher, Gering High School – Gering, NE
- Database Analyst, US Army Corps of Engineers – Omaha, NE
- Rotational Data Analyst, TD Ameritrade – Lincoln, NE
- ESL English Teacher, Lenzkids – Jinan, China
- Underwriter 1, Omaha National – Omaha, NE
- Formulation Engineer, Syngenta – Greensboro, NC
- Lab Technician, Nebraska Department of Transportation – Lincoln, NE
- Institutional Research Analyst, Northeast Community College – Norfolk, NE
- Client Implementations Technology Analyst, Fiserv – Lincoln, NE
- Associate Application Developer, Union Pacific – Omaha, NE

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
- Associate Logistics Professional Intern, ConAgra Foods - Omaha, NE

Graduate & Professional Schools
- Master's Degree, Business Analytics, George Washington University – Washington, DC
- Master's Degree, Education, Creighton University – Omaha, NE
- Master's Degree, Statistics & Data Science, University of Wisconsin - Madison – Madison, WI
- Master's Degree, Statistics, University of Illinois Urbana - Champaign – Champaign, IL
- Master's Degree, Business Administration, University of Notre Dame – South Bend, IN
- Master's Degree, Professional Accountancy, University of California - San Diego – San Diego, CA
- Master's Degree, Computer Science, University of Nebraska - Lincoln – Lincoln, NE
- Doctoral Degree, Mathematics, University of Nebraska - Lincoln – Lincoln, NE
- Doctoral Degree, Marketing, Florida State University – Tallahassee, FL
- Doctoral Degree, Applied Mathematics, University of Maryland – College Park, MD
- Doctoral Degree, Mathematics, Virginia Polytechnic Institute and State University – Blacksburg, VA