# 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.

**Program Assessment.** In order to assist the department in evaluating its programs, all majors should plan to participate in an electronic exit interview survey during their last semester before graduation.

## College Admission

The entrance requirements for the College of Arts and Sciences (CAS), including any of the majors or minors offered through the college, are the same as the University of Nebraska–Lincoln General Admission Requirements. 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 the University of Nebraska–Lincoln and provide more opportunity to study abroad.

## 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 (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 website (http://ace.unl.edu) for the most current list of certified courses.

### ACE Student Learning Outcomes

ACE 1: 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.

ACE 2: Demonstrate competence in communication skills.

ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: 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.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

# 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.
- Independent study or reading courses and internships cannot be used to satisfy distribution requirements.
- Courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

**College Distribution Requirements**

| | |
|---|---|
| *CDR: Written Communication* | *3* |
| Select from courses approved for ACE outcome 1. | |
| *CDR: Natural, Physical, and Mathematical Sciences with Lab* | *4* |
| Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, and physics. 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: Humanities* | *3* |
| Select from classics, English, film studies, history, modern languages and literatures, philosophy, and religious studies. [2] | |
| *CDR: Social Science* | *3* |
| Select from anthropology, communication studies, geography, national security studies, political science, psychology, or sociology. [3] | |
| *CDR: Human Diversity in U.S. Communities* | *0-3* |
| Select from a set of approved courses as listed in the degree audit. | |
| *CDR: Language* | *0-16* |
| 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. | |
| Credit Hours Subtotal: | 13-32 |

[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 220 and below do not fulfill the CDR Humanities.*

[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.*

## Language Requirement

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

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. Approved courses for scientific-based credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBIO 101), and physics (excluding PHYS 201.)

See your Degree Audit or your assigned academic 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 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 of C- and D grades can be applied toward requirements in a major or a minor. No University of Nebraska–Lincoln 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 the 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 the University of Nebraska–

Lincoln 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 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

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 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 the University of Nebraska–Lincoln.

# 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 time frame allowable for that catalog year.

# 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 a major in mathematics, standard option will:

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

Graduates with a major in mathematics, discrete mathematics and cryptography option will:

- 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 a major in mathematics, education option will:

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

Graduates with a major in mathematics, mathematical biology option will:

- 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 a major in mathematics, mathematical finance option will:

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

Graduates with a major in mathematics, mathematics of physical phenomena option will:

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

Graduates with a major in mathematics, statistics and data science option will:

- 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.

# Major Requirements

Complete the core requirements and the requirements of one option.

## Core Requirements
### Required Courses

| | | |
|---|---|---|
| MATH 106 | Calculus I | 5 |
| MATH 107 | Calculus II | 4 |
| MATH 314 | Linear Algebra | 3 |
| Credit Hours Subtotal: | | 12 |
| **Option Courses** | | |
| Select and complete the specific requirements for one of seven options described below to complete the major. | | 30-43 |
| Credit Hours Subtotal: | | 30-43 |
| **Total Credit Hours** | | **42-55** |

## Standard Option
### Required Courses

| | | |
|---|---|---|
| MATH 208 | Calculus III | 4 |
| MATH 221 | Differential Equations | 3 |
| or STAT 380 | Statistics and Applications | |
| MATH 310 | Introduction to Modern Algebra | 3 |
| MATH 325 | Elementary Analysis | 3 |
| Credit Hours Subtotal: | | 13 |
| **Additional MATH Courses [1]** | | |
| Select four additional advanced MATH courses with at least two at the 400 level. | | 12 |
| 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. | | 18 |
| 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

| | | |
|---|---|---|
| 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 MATH courses at the 400 level. [1] | | 6 |
| Credit Hours Subtotal: | | 9 |
| **Computer Science Courses** | | |
| CSCE 155T | Computer Science I: Informatics Focus | 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 183H / RAIK 183H | Honors: Computer Problem Solving Essentials | |
| CSCE 311 | Data Structures and Algorithms for Informatics | 3 |
| or CSCE 310 | Data Structures and Algorithms | |
| or SOFT 260H / RAIK 283H | Honors: Software Engineering III | |
| 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** |

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

## Education Option
### Required Courses

| MATH 208 | Calculus III | 4 |
|---|---|---|
| MATH 309 | Introduction to Mathematical Proofs | 3 |
| or MATH 310 | Introduction to Modern Algebra | |
| MATH 325 | Elementary Analysis | 3 |
| MATH 407 | Mathematics for High School Teaching I | 3 |
| MATH 408 | Mathematics for High School Teaching II | 3 |
| MATH 412 | Modern Geometry | 3 |
| STAT 380 | Statistics and Applications | 3 |
| Credit Hours Subtotal: | | 22 |
| **Additional Courses** | | |
| Select one additional 400-level MATH [1] | | 3 |
| 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. | | 18 |

| 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

| MATH 221 | Differential Equations | 3 |
|---|---|---|
| MATH 309 | Introduction to Mathematical Proofs | 3 |
| MATH 325 | Elementary Analysis | 3 |
| MATH 439 | Mathematical Biology | 3 |
| STAT 380 | Statistics and Applications | 3 |
| Credit Hours Subtotal: | | 15 |
| **Additional Mathematics Courses** | | |
| Select two additional advanced MATH courses at the 400 level. [1] | | 6 |
| 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 452 | Ecology and Evolution and Field Epidemiology | |
| BIOS 207 & BIOS 453 | Ecology and Evolution 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. [1] | | 3 |
| Credit Hours Subtotal: | | 9 |
| **Actuarial Science and Finance Courses** | | |
| ACTS 440 | Interest Theory | 4 |
| FINA 367 | Fixed Income Investments | 3 |
| FINA 467 | Options, Futures and Derivative Securities | 3 |
| Credit Hours Subtotal: | | 10 |
| **Total Credit Hours** | | **35-36** |

[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. [1] | | 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: | | 6-16 |
| ECEN 215 & ECEN 216 & ECEN 304 & ECEN 462 | Electronics and Circuits I and Electronics and Circuits II and Signals and Systems I and Communication Systems | |
| ECEN 215 & ECEN 216 & ECEN 304 & ECEN 463 | Electronics and Circuits I and Electronics and Circuits II and Signals and Systems I and Digital Signal Processing | |
| ECEN 215 & ECEN 306 & ECEN 408 | Electronics and Circuits I and Electromagnetic Field Theory and Engineering Electromagnetics | |
| ECEN 215 & ECEN 306 & ECEN 467 | Electronics and Circuits I and Electromagnetic Field Theory and Electromagnetic Theory and Applications | |
| GEOL 101 & GEOL 441 & GEOL 372 | Dynamic Earth and Geophysics and Water & Earth Connections | |
| GEOL 106 & GEOL 441 & GEOL 372 | Environmental Geology and Geophysics and Water & Earth Connections | |
| MECH 223 & MECH 310 & MECH 373 | Engineering Statics and Fluid Mechanics and Engineering Dynamics | |
| MECH 223 & MECH 325 & MECH 451 | Engineering Statics and Mechanics of Elastic Bodies and Introduction to Finite Element Analysis | |
| MECH 223 & MECH 350 & MECH 373 | Engineering Statics and Introduction to Dynamics and Control of Engineering Systems and Engineering Dynamics | |
| MECH 223 & MECH 373 & MECH 449 | Engineering Statics and Engineering Dynamics and Advanced Dynamics | |
| MECH 223 & MECH 373 & MECH 451 | Engineering Statics and Engineering Dynamics and Introduction to Finite Element Analysis | |
| MECH 223 & MECH 373 & MECH 475 | Engineering Statics and Engineering Dynamics and Introduction to Mechanical Vibrations | |
| METR 100 & METR 205 & METR 223 & METR 311 | Weather and Climate and Introduction to Atmospheric Science and Atmospheric Thermodynamics and Dynamic Meteorology I | |
| METR 100 & METR 205 & METR 223 & METR 323 | Weather and Climate and Introduction to Atmospheric Science and Atmospheric Thermodynamics and Physical Meteorology | |
| METR 100 & GEOL 441 & GEOL 372 | Weather and Climate and Geophysics and Water & Earth Connections | |
| PHYS 213 & ECEN 417 & ECEN 421 | General Physics III and Semiconductor Fundamentals II and Principles of Semiconductor Materials and Devices I | |
| PHYS 213 & ECEN 420 & ECEN 421 | General Physics III and Plasma Processing of Semiconductors and Principles of Semiconductor Materials and Devices I | |
| PHYS 213 & PHYS 311 | General Physics III and Mechanics | |
| PHYS 213 & PHYS 431 | General Physics III 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** |

[1] *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 or MATH 325 | Introduction to Modern Algebra Elementary Analysis | 3 |
| STAT 380 | Statistics and Applications | 3 |

| | | |
|---|---|---|
| Credit Hours Subtotal: | | 13 |

**Additional Mathematics Courses**

| | | |
|---|---|---|
| Select one of the following MATH courses: | | 3 |
| MATH 428 | Principles of Operations Research | |
| 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. [1] | | 3 |
| Credit Hours Subtotal: | | 6 |

**Additional Statistics Courses**

| | | |
|---|---|---|
| Select two additional STAT courses at the 300 or 400 level. | | 6 |
| 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 / RAIK 183H | Honors: Computer Problem Solving Essentials | |
| CSCE 311 | Data Structures and Algorithms for Informatics | 3 |
| or CSCE 310 | Data Structures and Algorithms | |
| or SOFT 260H / RAIK 283H | Honors: Software Engineering III | |
| 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 | |
| Set 2 | | |
| CSCE 411 | Data Modeling for Systems Development | |
| CSCE 412 | Data Visualization | |
| CSCE 413 | Database Systems | |
| CSCE 439 | Robotics: Algorithms and Applications | |
| CSCE 472 | Digital Image Processing | |
| CSCE 473 | Computer Vision | |
| CSCE 474 | Introduction to Data Mining | |
| Credit Hours Subtotal: | | 12 |
| **Total Credit Hours** | | **37** |

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

# Additional Major Requirements
## 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.

## Prerequisite Requirements/Rules
Math majors who earn less than a grade of C or P in a major course must retake that course before moving on to any other course for which it is a prerequisite.

## Restrictions
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.

# Requirements for Minor Offered by Department
A complete calculus sequence plus three advanced mathematics courses OR two calculus courses with four advanced mathematics courses. [1]

**Required Calculus Courses**

| | | |
|---|---|---|
| MATH 106 | Calculus I | 5 |
| MATH 107 | Calculus II | 4 |
| Credit Hours Subtotal: | | 9 |

**Additional MATH Courses**

| | | |
|---|---|---|
| Select four additional MATH courses from the following: | | 12-13 |
| MATH 208 | Calculus III | |
| MATH 221 | Differential Equations | |
| MATH 309 | Introduction to Mathematical Proofs | |
| MATH 310 | Introduction to Modern Algebra | |
| 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 100A; 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, 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
**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 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 109A; CHEM 113A; 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, WATS 361; PLAS 458, AGRO 858, NRES 458, NRES 858, SOIL 458; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472, WATS 472
**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, WATS 361; PLAS 458, AGRO 858, NRES 458, NRES 858, SOIL 458; SOFT 160; SOFT 160H
**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; ACCT 308; ACCT 309; ACCT 313; AECN 465, AECN 865, NREE 465, WATS 465; AGST 109; ARCH 333, CNST 305; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 355; CONE 221; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; ECON 215; ECON 215H; ECON 311A; ECON 311B; ECON 312A; ECON 312B; FDST 363, AGST 363; FINA 361; FINA 361A; FINA 361H; MATH 104; MATH 315; METR 100; METR 140; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 151; PLAS 361, GEOL 361, NRES 361, SOIL 361, WATS 361; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472, WATS 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 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
**Grading Option:** Graded with Option
**Prerequisite for:** ABUS 341, MRKT 341; ACCT 200; ACCT 201; ACCT 308; ACCT 309; ACCT 313; AGEN 112, BSEN 112; AGEN 225, BSEN 225; AGST 109; ARCH 333, CNST 305; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 355; CHEM 109A; CHME 114; CNST 241; CNST 242; CNST 251; CNST 252; CNST 306; CONE 221; CRIM 300; CSCE 155A; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; CSCE 156H; CSCE 235; CSCE 235H; ECEN 103; ECON 215; ECON 215H; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FDST 363, AGST 363; FINA 361; FINA 361A; FINA 361H; GEOL 200; GEOL 410; MATH 106; MATH 107; MATH 107H; MECH 220; METR 100; METR 140; METR 205; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PLAS 361, GEOL 361, NRES 361, SOIL 361, WATS 361; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472, WATS 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; series, Taylor series, vectors, cross and dot products, lines and planes, space curves.
**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; AREN 211; ASTR 204; BIOC 440; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 244; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 109A; CHME 114; CHME 202; CHME 212; CHME 331; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; CSCE 156H; ECEN 211; ECEN 224; ECON 215; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FINA 361; FINA 361A; FINA 361H; MATH 107; MATH 208; MATH 208H; MATH 221; MATH 221H; MATH 309; MATH 310; MATH 314; MATH 314H; MATH 315; 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 211; PHYS 211H; PHYS 212; PHYS 212H; PLAS 361, GEOL 361, NRES 361, SOIL 361, WATS 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 380, RAIK 270H
**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
**Prerequisite for:** ABUS 341, MRKT 341; ACCT 200; ACCT 201; AREN 211; BIOC 440; BLAW 371; BLAW 371H; BLAW 372H; BSEN 244; CHME 202; CHME 212; CHME 331; CRIM 300; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; CSCE 156H; ECEN 211; ECEN 224; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 208H; MATH 221; MATH 221H; MATH 309; MATH 310; MATH 314; MATH 314H; MATH 315; 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 211; PHYS 211H; PHYS 212; PHYS 212H; PLAS 361, GEOL 361, NRES 361, SOIL 361, WATS 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 380, RAIK 270H
**ACE:** ACE 3 Math/Stat/Reasoning

**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; ACCT 200; ASTR 204; BLAW 371; BLAW 371H; BLAW 372; BSEN 244; CHME 202; CHME 212; CHME 331; CRIM 300; 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; METR 223; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211H; PHYS 212; PLAS 361, GEOL 361, NRES 361, SOIL 361, WATS 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 203J Contemporary Math**
**Prerequisites:** Must be admitted to the College of Journalism
**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 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
**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 401; 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; CSCE 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MATH 325; MECH 223H; 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 211; PHYS 211H; PHYS 213; 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; ACTS 401; 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; CSCE 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MATH 325; MECH 223H; 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 213; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462
**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; BSEN 317; BSEN 943; BSEN 954, NRES 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; BSEN 260, AGEN 260; BSEN 311; BSEN 317; CHME 312; 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 810; PHYS 311

**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 301; TEAC 297E; TEAC 308
**Groups:** Introductory Mathematics

**MATH 301 Geometry Matters**
**Prerequisites:** MATH 300
**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
**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:** 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 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
**Grading Option:** Graded with Option
**Prerequisite for:** MATH 325; MATH 412; MATH 430; MATH 450; MATH 452; MATH 460; MATH 471

**MATH 310 Introduction to Modern Algebra**
**Prerequisites:** A grade of P, C, or better in MATH 107 or MATH 107H
**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
**Grading Option:** Graded with Option
**Prerequisite for:** MATH 325; MATH 412; MATH 417; MATH 430; MATH 450; MATH 452; MATH 460; MATH 471

**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 linearequations, 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 208/208H, 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
**Prerequisite for:** MATH 412; MATH 425; MATH 430; MATH 450; MATH 452; MATH 460; MATH 471

**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 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
**ACE:** ACE 10 Integrated Product

**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, RAIK 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
**Prerequisite for:** CSCE 942
**Course and Laboratory Fee:** $20

**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
**Offered:** FALL

**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

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 - 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

- 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 Prefessional 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, ID
- 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