

# 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 pursuing the bachelor of science may choose 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 consult with faculty and their academic advisor, which specific option to follow. The option will be documented on the final transcript.

### Standard Option

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

### 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.

### Statistics and Data Science

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

### 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.

### Mathematical Biology Option

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

### Mathematical Finance Option

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

### 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.

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

## 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 UNL 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 UNL and provide more opportunity to study abroad.

## ACADEMIC AND CAREER Advising Academic and Career Advising Center

The Academic and Career Advising Center in 107 Oldfather Hall 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. Students visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check in on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representative, Sr. Director of Advising and Student Success.

While the assigned academic advisor should be the student's primary contact, there are daily walk-ins from 12-3 where a general academic advisor can answer a quick question. In addition, the CAS Career Coaches are located here. They help students explore majors and minors, gain experience, and develop a plan for life after graduation. Not sure where to go or who to ask? The Advising Center team can help.

## 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.

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 or in the Academic and Career Advising Center. 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, contact the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, <http://cas.unl.edu/advising>.

## 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 not only prepared to effectively contribute professionally in the real world, but they have 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, 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

<i>CDR: Written Communication</i>	3
Select from courses approved for ACE outcome 1.	
<i>CDR: Natural, Physical, and Mathematical Sciences with Lab</i>	4
Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, physics, and statistics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology, and physics.	
Some courses from geography and anthropology may also be used to satisfy the lab requirement above. <sup>1</sup>	
<i>CDR: Humanities</i>	3
Select from classics, English, history, modern languages and literatures, philosophy, and religious studies. <sup>2</sup>	
<i>CDR: Social Science</i>	3
Select from anthropology, communication studies, geography, political science, psychology, or sociology. <sup>3</sup>	
<i>CDR: Human Diversity in U.S. Communities</i>	0-3
Select from a set of approved courses as listed in the degree audit.	
<i>CDR: Language</i>	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

<sup>1</sup> See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.

<sup>2</sup> Language courses numbered 220 and below do not fulfill the CDR Humanities.

<sup>3</sup> 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

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

## 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 base 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), computer science (excluding CSCE 10), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBIO 101), and physics.

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 UNL C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by College of Arts and Sciences departments to be degree applicable.

### Pass/No Pass Privilege

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

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

## Grading Appeals

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

1. Talk 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 UNL.

## Residency Requirement

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

## Catalog to Use

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

## Learning Outcomes

Graduates of mathematics will be able to:

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

## Major Requirements

### Bachelor of Science

Complete the core requirements and 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**

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
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**Education Option****Required Courses**

MATH 208	Calculus III	4
MATH 310	Introduction to Modern Algebra	3
MATH 325	Elementary Analysis	3
MATH 350	Geometry for High School Teaching	3
MATH 405	Discrete and Finite Mathematics for High School Teaching	3
MATH 407	Mathematics for High School Teaching I	3
MATH 408	Mathematics for High School Teaching II	3
STAT 380	Statistics and Applications	3
Credit Hours Subtotal:		25

**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
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**Statistics and Data Science****Required Courses**

MATH 208	Calculus III	4
MATH 309	Introduction to Mathematical Proofs	3
MATH 310	Introduction to Modern Algebra	3
or MATH 325	Elementary Analysis	
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	
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MATH 487	Probability Theory	
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MATH 489	Stochastic Processes	
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Select one additional advanced MATH course at the 400 level.	3
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Credit Hours Subtotal:	6
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**Additional Statistics Courses**

Select two additional STAT courses at the 300 or 400 level.	6
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Credit Hours Subtotal:	6
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**Computer Science Courses**

CSCE 155T	Computer Science I: Informatics Focus	3
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CSCE 311	Data Structures and Algorithms for Informatics	3
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Select two courses from one of the following sets of courses:	6
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**Set 1**

CSCE 421	Foundations of Constraint Processing	
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or CSCE 439 Robotics: Algorithms and Applications

or CSCE 474 Introduction to Data Mining

or CSCE 476 Introduction to Artificial Intelligence

or CSCE 478 Introduction to Machine Learning

or CSCE 479 Introduction to Deep Learning

**Set 2**

CSCE 411	Data Modeling for Systems Development	
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or CSCE 412 Data Visualization

or CSCE 413 Database Systems

or CSCE 439 Robotics: Algorithms and Applications

or CSCE 472 Digital Image Processing

or CSCE 473 Computer Vision

or CSCE 474 Introduction to Data Mining

Credit Hours Subtotal:	12
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Total Credit Hours	37
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**Mathematics of Physical Phenomena Option****Required Courses**

MATH 208	Calculus III	4
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MATH 221	Differential Equations	3
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MATH 309	Introduction to Mathematical Proofs	3
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MATH 325	Elementary Analysis	3
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Credit Hours Subtotal:	13
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**Additional Mathematics Courses**

Select two additional advanced MATH courses at the 400 level.	6
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Credit Hours Subtotal:	6
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**Physics Courses**

PHYS 211	General Physics I	4
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PHYS 212	General Physics II	4
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Credit Hours Subtotal:	8
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**Physical Phenomena Sequence**

Select and complete one of the following sequences from physics, meteorology, geology, or engineering:	6-16
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PHYS 213 & PHYS 311	General Physics III and Mechanics	
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PHYS 213 & PHYS 431	General Physics III and Thermal Physics	
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PHYS 213 & PHYS 451	General Physics III and Electromagnetic Theory
PHYS 311 & PHYS 401	Mechanics and Computational Physics
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
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 350 & MECH 373	Engineering Statics and Introduction to Dynamics and Control of Engineering Systems and Engineering Dynamics
MECH 223 & MECH 373 & MECH 475	Engineering Statics and Engineering Dynamics and Introduction to Mechanical Vibrations
MECH 223 & MECH 373 & MECH 451	Engineering Statics and Engineering Dynamics and Introduction to Finite Element Analysis
MECH 223 & MECH 373 & MECH 449	Engineering Statics and Engineering Dynamics and Advanced Dynamics
MECH 223 & MECH 325 & MECH 451	Engineering Statics and Mechanics of Elastic Bodies and Introduction to Finite Element Analysis
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

PHYS 213 & ECEN 420 & ECEN 421	General Physics III and Plasma Processing of Semiconductors and Principles of Semiconductor Materials and Devices I
PHYS 213 & ECEN 417 & ECEN 421	General Physics III and Semiconductor Fundamentals II and Principles of Semiconductor Materials and Devices I
Credit Hours Subtotal: 6-16	
Total Credit Hours 33-43	

**Mathematical Biology Option**

<b>Required Courses</b>		
MATH 221	Differential Equations	3
MATH 309	Introduction to Mathematical Proofs	3
MATH 325	Elementary Analysis	3
MATH 439	Mathematical Models in Biology	3
STAT 380	Statistics and Applications	3
Credit Hours Subtotal:		15
<b>Additional Mathematics Courses</b>		
Select two additional advanced MATH courses at the 400 level.		6
Credit Hours Subtotal:		6
<b>Biological Sciences Courses</b>		
LIFE 120 & LIFE 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	4
LIFE 121 & LIFE 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory	4
Select one of the following sequences:		7-8
BIOS 206 & BIOS 337	General Genetics and Applications of Bioinformatics	
BIOS 206 & BIOS 426	General Genetics and Systems Biology	
BIOS 206 & BIOS 427	General Genetics and Practical Bioinformatics Laboratory	
BIOS 207 & BIOS 453	Ecology and Evolution and Predator Ecology	
BIOS 207 & BIOS 452	Ecology and Evolution and Field Epidemiology	
Credit Hours Subtotal:		15-16
Total Credit Hours		36-37

**Mathematical Finance Option**

<b>Required Courses</b>		
MATH 208	Calculus III	4
MATH 221	Differential Equations	3
STAT 380	Statistics and Applications	3
Credit Hours Subtotal:		10
<b>Additional Mathematics and Statistics Courses</b>		
Select two courses from the following:		6
MATH 309	Introduction to Mathematical Proofs	
MATH 310	Introduction to Modern Algebra	
MATH 325	Elementary Analysis	
MATH 487	Probability Theory	3-4



or STAT 462	Introduction to Mathematical Statistics I: Distribution Theory	
MATH 489	Stochastic Processes	3
Select one additional advanced MATH courses at the 400 level.		3
Credit Hours Subtotal:		15-16
<b>Actuarial Science or Finance Courses</b>		
ACTS 440	Interest Theory	4
ACTS 441	Introduction to Financial Economics	3
FINA 467A	Options, Futures and Derivative Securities for Actuarial Science	3
Credit Hours Subtotal:		10
Total Credit Hours		35-36

### Discrete Mathematics and Cryptography Option

#### 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.		6
Credit Hours Subtotal:		9

#### Computer Science Courses

CSCE 155A	Computer Science I	3
or CSCE 155E	Computer Science I: Systems Engineering Focus	
or CSCE 155H	Honors: Computer Science I	
or CSCE 155N	Computer Science I: Engineering and Science Focus	
or CSCE 155T	Computer Science I: Informatics Focus	
CSCE 311	Data Structures and Algorithms for Informatics	3
Select two courses from the following:		6
CSCE 423	Design and Analysis of Algorithms	
CSCE 424	Computational Complexity Theory	
CSCE 428	Automata, Computation, and Formal Languages	
CSCE 463	Data and Network Security	
CSCE 477	Cryptography and Computer Security	
Credit Hours Subtotal:		12
Total Credit Hours		30-31

### Bachelor of Arts

The BA program is ideal for the student who wants to combine a mathematics major with another major or several minors in the

humanities or the social sciences or for the student dual matriculating with another college.

### Core Requirements

#### Required Courses

MATH 106	Calculus I	5
MATH 107	Calculus II	4
MATH 208	Calculus III	4
MATH 221	Differential Equations	3
or STAT 380	Statistics and Applications	
MATH 310	Introduction to Modern Algebra	3
MATH 314	Linear Algebra	3
MATH 325	Elementary Analysis	3
Credit Hours Subtotal:		25
Total Credit Hours		25

### Specific Major Requirements

#### Additional Advanced Mathematics Courses

Select three additional advanced MATH courses with at least two at the 400 level.		9
Credit Hours Subtotal:		9
Total Credit Hours		9

## 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 104 unless given permission by the math department advisor. All special topics, independent study, seminar, and reading courses require permission of the instructor before registering, and these courses do not count toward the major requirements unless approved by the faculty advisor.

## Requirements for Minor Offered by Department

### Plan A Minor (21-22 hours)

A complete calculus sequence plus three advanced mathematics courses OR two calculus courses with four advanced mathematics courses.<sup>1</sup>

#### Required Calculus Courses

MATH 106	Calculus I	5
MATH 107	Calculus II	4

Credit Hours Subtotal:	9
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**Additional MATH Courses**

Select four additional MATH courses from the following:	12-13
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MATH 208	Calculus III
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MATH 221	Differential Equations
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MATH 309	Introduction to Mathematical Proofs
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MATH 310	Introduction to Modern Algebra
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MATH 314	Linear Algebra
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MATH 325	Elementary Analysis
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STAT 380	Statistics and Applications
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400-level MATH courses <sup>1</sup>	
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Credit Hours Subtotal:	12-13
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Total Credit Hours	21-22
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<sup>1</sup> The following 400-level courses cannot be used to fulfill the minor requirements: MATH 405, MATH 407, and MATH 408.

**Plan B Minor (15-16 hours)**

A complete calculus sequence plus one advanced mathematics course OR two calculus courses with two advanced mathematics courses.<sup>1</sup>

**Required Calculus Courses**

MATH 106	Calculus I	5
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MATH 107	Calculus II	4
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Credit Hours Subtotal:	9
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**Additional MATH Course**

Select two additional MATH courses from the following:	6-7
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MATH 208	Calculus III
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MATH 221	Differential Equations
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MATH 309	Introduction to Mathematical Proofs
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MATH 310	Introduction to Modern Algebra
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MATH 314	Linear Algebra
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MATH 325	Elementary Analysis
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STAT 380	Statistics and Applications
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400-level MATH courses <sup>1</sup>	
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Credit Hours Subtotal:	6-7
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Total Credit Hours	15-16
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<sup>1</sup> The following 400-level courses cannot be used to fulfill the minor requirements: MATH 405, MATH 407, and MATH 408.

**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 104 unless given permission by the math department advisor. All special topics, independent study, seminar, and reading courses require permission of the instructor before registering, and these

courses do not count toward the major requirements unless approved by the faculty advisor.

**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

**Groups:** Introductory Mathematics

**MATH 101 College Algebra**

**Prerequisites:** Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A.

**Notes:** Credit for both MATH 101 and 103 is not allowed; students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.

**Description:** Real numbers, exponents, factoring, linear and quadratic equations, absolute value, inequalities, functions, graphing, polynomial and rational functions, exponential and logarithmic functions, system of equations.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** CHEM 105; CHEM 105A; CRIM 300; MATH 102; MATH 104; METR 100; METR 140; MSYM 109; PHYS 260; PHYS 261

**Groups:** Introductory Mathematics

**MATH 102 Trigonometry**

**Prerequisites:** Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101.

**Notes:** Credit for both MATH 102 and 103 is not allowed; students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.

**Description:** Trigonometric functions, identities, trigonometric equations, solution of triangles, inverse trigonometric functions and graphs.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Graded with Option

**Prerequisite for:** AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 458, AGRO 858, NRES 458, NRES 858, SOIL 458; ASCI 340; CHEM 109; CHEM 109A; CHEM 113A; CRIM 300; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; GEOL 200; MATH 104; MATH 106; METR 100; METR 140; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261

**Groups:** Introductory Mathematics

**MATH 103 College Algebra and Trigonometry**

**Prerequisites:** Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A.

**Notes:** Credit for both MATH 101 and 103 is not allowed; credit for both MATH 102 and MATH 103 is not allowed; students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.

**Description:** First and second degree equations and inequalities, absolute value, functions, polynomial and rational functions, exponential and logarithmic functions, trigonometric functions and identities, laws of sines and cosines, applications, polar coordinates, systems of equations, graphing, conic sections.

**Credit Hours:** 5

**Max credits per semester:** 5

**Max credits per degree:** 5

**Grading Option:** Graded with Option

**Prerequisite for:** AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 458, AGRO 858, NRES 458, NRES 858, SOIL 458; ASCI 340; CHEM 105A; CHEM 109; CHEM 109A; CHEM 113A; CRIM 300; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; GEOL 200; MATH 104; MATH 106; METR 100; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261; SOFT 160; SOFT 160H

**Groups:** Introductory Mathematics

**MATH 104 Applied Calculus**

**Prerequisites:** Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101, MATH 102 or MATH 103.

**Description:** Rudiments of differential and integral calculus with applications to problems from business, economics, and social sciences.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**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; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 472, AGRO 872, NRES 472, NRES 872, SOIL 472, WATS 472; ARCH 333, CNST 305; ASCI 340; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 355; CHEM 109A; CNST 241; CNST 242; CNST 251; CNST 252; CNST 306; CRIM 300; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; ECON 215; ECON 215H; ECON 311; FDST 363, MSYM 363; FINA 361; FINA 361H; MATH 104; METR 100; METR 140; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H

**ACE:** ACE 3 Math/Stat/Reasoning

**Groups:** Introductory Mathematics

**MATH 106 Calculus I**

**Prerequisites:** Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 102 or MATH 103.

**Notes:** Credit for both MATH 104 and MATH 106 is not allowed.

**Description:** Functions of one variable, limits, differentiation, exponential, trigonometric and inverse trigonometric functions, maximum-minimum, and basic integration theory (Riemann sums) with some applications.

**Credit Hours:** 5

**Max credits per semester:** 5

**Max credits per degree:** 5

**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; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 472, AGRO 872, NRES 472, NRES 872, SOIL 472, WATS 472; ARCH 333, CNST 305; ASCI 330; ASCI 340; BIOS 316, MATH 316, NRES 316; BIOS 316L; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 355; CHEM 109A; CHME 114; CIVE 221, CONE 221; CNST 241; CNST 242; CNST 251; CNST 252; CNST 306; CRIM 300; CSCE 155A; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; CSCE 235, CSCE 235H; ECEN 103; ECON 215; ECON 215H; ECON 311; FDST 363, MSYM 363; FINA 361; FINA 361H; GEOL 410; MATH 106; MATH 107; MATH 107H; MECH 220; METR 100; METR 140; METR 205; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H

**ACE:** ACE 3 Math/Stat/Reasoning

**Groups:** Introductory Mathematics

**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; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AREN 211; ASTR 204; BIOC 440; BLAW 371; BLAW 371H; BLAW 372; BLAW 372H; BSEN 244; CHEM 109A; CHME 202; CHME 331; CRIM 300; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 211; ECEN 224; ECON 215; ECON 311; FINA 361; FINA 361H; MATH 107; MATH 208; MATH 208H; MATH 221; MATH 221H; MATH 309; MATH 310; MATH 314; MATH 314H; MECH 223; MECH 223H; METR 100; METR 140; METR 223; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PHYS 212H; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 380, STAT 380H, RAIK 270H

**ACE:** ACE 3 Math/Stat/Reasoning

**Groups:** Introductory Mathematics



**MATH 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; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AREN 211; BIOC 440; BLAW 371; BLAW 371H; BLAW 372H; BSEN 244; CHME 202; CHME 331; CRIM 300; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 211; ECEN 224; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 208H; MATH 221; MATH 221H; MATH 309; MATH 310; MATH 314; MATH 314H; MECH 223; MECH 223H; METR 100; METR 140; METR 223; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PHYS 212H; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 380, STAT 380H, RAIK 270H

**ACE:** ACE 3 Math/Stat/Reasoning

**Groups:** Introductory Mathematics

**MATH 107R Analytic Geometry and Calculus II**

**Prerequisites:** A grade of P, C or better in MATH 106.

**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; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; ASTR 204; BLAW 371; BLAW 371H; BLAW 372; BSEN 244; CHME 202; CHME 331; CRIM 300; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; ECEN 211; ECON 215; ECON 311; 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; PHYS 260; PHYS 261; 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; PHYS 141; PHYS 260; PHYS 261

**ACE:** ACE 3 Math/Stat/Reasoning

**Groups:** Introductory Mathematics

**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; PHYS 141; PHYS 260; PHYS 261

**Groups:** Seminars, Ind Study, Topics

**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

**Groups:** Introductory Mathematics

**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; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 221; MATH 314; MATH 325; MATH 407; MATH 495; 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 262; STAT 462

**ACE:** ACE 3 Math/Stat/Reasoning

**Groups:** Introductory Mathematics

**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; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156; CSCE 156H; ECEN 215; ECEN 305; ECEN 306; ECEN 328; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 221; MATH 314; MATH 325; MATH 407; MATH 495; 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

**Groups:** Introductory Mathematics

**MATH 221 Differential Equations**

**Prerequisites:** A grade of P, C, or better in MATH 107 or MATH 107H

**Description:** First- and second-order methods for ordinary differential equations including: separable, linear, Laplace transforms, linear systems, and some applications.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**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 326, CIVE 326; BSEN 326H, CIVE 326H; 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

**ACE:** ACE 3 Math/Stat/Reasoning

**MATH 221H Honors:Differential Equations**

**Prerequisites:** Good Standing in the University Honors Program and a grade of P, C, or better in MATH 107 or MATH 107H

**Description:** For course description, see MATH 221/821.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**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; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; 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

**ACE:** ACE 3 Math/Stat/Reasoning

**MATH 300 Mathematics Matters**

**Prerequisites:** TEAC 308 or TEAC 416D or parallel.

**Notes:** Credit toward the degree may be earned in only one of: MATH 300 or MATH 300M.

**Description:** Numbers and operations. Develop an understanding of mathematics taught in the elementary school.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**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

**Groups:** Introductory Mathematics

**MATH 302 Math Modeling**

**Notes:** MATH 300 is a strongly recommended prerequisite. Intended for middle grades teaching endorsement majors with a mathematics emphasis and/or to elementary education majors who want a mathematics concentration.

**Description:** Using mathematics to model solutions or relationships for realistic problems taken from the middle school curriculum. The mathematics for these models are a mix of algebra, geometry, sequences (dynamical systems, queuing theory), functions (linear, exponential, logarithmic), and logic. Mathematical terminology, concepts and principles. Calculator based lab devices, graphing calculators, and computers as tools to collect data, to focus on concepts and ideas, and to make the mathematics more accessible.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Groups:** Introductory Mathematics

**MATH 309 Introduction to Mathematical Proofs**

**Prerequisites:** A grade of P, C, or better in MATH 107 or MATH 107H

**Description:** Basic set theory; elements of logic and types of proofs; induction; study of relations and functions; and cardinality of sets.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** MATH 325; MATH 430; MATH 450; 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 350; MATH 407; MATH 408; MATH 417; MATH 430; MATH 450; MATH 452; 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 405; MATH 430; MATH 435; MATH 471; MECH 350; STAT 871; STAT 970**ACE:** ACE 3 Math/Stat/Reasoning**MATH 314H Honors: Linear Algebra****Prerequisites:** Good Standing in the University Honors Program and a grade of P, C, or better in MATH 107 or MATH 107H**Description:** For course description, see MATH 314.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** MATH 405; MATH 430; MATH 471; MECH 350; STAT 871**ACE:** ACE 3 Math/Stat/Reasoning**MATH 316 Case Studies in Theoretical Ecology****Crosslisted with:** BIOS 316, NRES 316**Prerequisites:** MATH 106 or higher OR LIFE 121. Parallel registration in BIOS 316L.**Description:** Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to field questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 4 Science**Groups:** Advanced Mathematics Courses**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 425; MATH 430; MATH 450; MATH 452; MATH 471**MATH 350 Geometry for High School Teaching****Prerequisites:** A grade of P, C, or better in MATH 310 or MATH 310H**Notes:** NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.**Description:** Modern elementary geometry, plane transformations and applications, the axiomatic approach, Euclidean constructions. Additional topics vary.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** MATH 408**Groups:** Introductory Mathematics**MATH 398 Special Topics in Mathematics****Prerequisites:** Permission.**Credit Hours:** 1-24**Min credits per semester:** 1**Max credits per semester:** 24**Max credits per degree:** 24**Grading Option:** Pass No Pass**Groups:** Seminars, Ind Study, Topics**MATH 399 Independent Study in Mathematics****Prerequisites:** Permission.**Credit Hours:** 1-24**Min credits per semester:** 1**Max credits per semester:** 24**Max credits per degree:** 24**Grading Option:** Graded with Option**Groups:** Seminars, Ind Study, Topics**MATH 399H Honors Course****Prerequisites:** Permission.**Credit Hours:** 1-4**Min credits per semester:** 1**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Groups:** Seminars, Ind Study, Topics

**MATH 405 Discrete and Finite Mathematics for High School Teaching****Prerequisites:** A grade of P, C, or better in MATH 314 or MATH 314H**Notes:** Credit is not allowed for both CSCE 235 and MATH 405.**Description:** Graphs and networks. Map coloring. Finite differences. Pascal's triangle. The Pigeonholed Principle. Markov chains. Linear programming. Game Theory.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Groups:** Advanced Mathematics Courses**MATH 407 Mathematics for High School Teaching I****Prerequisites:** A grade of C, P, or better in MATH 208/208H and 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**MATH 408 Mathematics for High School Teaching II****Prerequisites:** A grade of C, P, or better grade in MATH 310 and 350**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**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 or MATH 310H**Description:** Elementary group theory, including cyclic, dihedral, and permutation groups; subgroups, cosets, normality, and quotient groups; fundamental isomorphism theorems; the theorems of Cayley, Lagrange, and Cauchy; and if time allows, Sylow's theorems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**Groups:** Advanced Mathematics Courses**MATH 423 Complex Analysis****Crosslisted with:** MATH 823**Prerequisites:** A grade of P, C, or better in MATH 208 or MATH 208H**Description:** Complex numbers, functions of complex variables, analytic functions, complex integration, Cauchy's integral formulas, Taylor and Laurent series, calculus of residues and contour integration, conformal mappings, harmonic functions. Applications of these concepts in engineering, physical sciences, and mathematics.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Groups:** Advanced Mathematics Courses**MATH 424 Introduction to Partial Differential Equations****Crosslisted with:** MATH 824**Prerequisites:** A grade of P, C, or better in MATH 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**Groups:** Advanced Mathematics Courses**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 MATH314H; 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 314/814 and MATH 310 or MATH 325

**Description:** Mathematical theory of unconstrained and constrained optimization for nonlinear multivariate functions, particularly iterative methods, such as quasi-Newton methods, least squares optimization, and convex programming. Computer implementation of these methods.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Groups:** Advanced Mathematics Courses

**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

**MATH 439 Mathematical Models in Biology**

**Crosslisted with:** MATH 839

**Prerequisites:** A grade of P, C, or better in MATH 221/221H.

**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, MATH 942

**MATH 441 Approximation of Functions**

**Crosslisted with:** CSCE 441, CSCE 841, MATH 841

**Prerequisites:** MATH 221/MATH 221H and MATH 314/MATH 314H.

**Description:** Polynomial interpolation, uniform approximation, orthogonal polynomials, least-first-power approximation, polynomial and spline interpolation, approximation and interpolation by rational functions.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** CSCE 942, MATH 942

**Groups:** Advanced Mathematics Courses

**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 Linear Algebra**

**Crosslisted with:** CSCE 447, CSCE 847, MATH 847

**Prerequisites:** MATH 314

**Description:** Mathematics and algorithms for numerically stable matrix and linear algebra computations, including solution of linear systems, computation of eigenvalues and eigenvectors, singular value decomposition, and QR decomposition.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** CSCE 942, MATH 942

**Groups:** Advanced Mathematics Courses

**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 310 or MATH 325

**Notes:** Selected applications.

**Description:** Theory of directed and undirected graphs. Trees, circuits, subgraphs, matrix representations, coloring problems, and planar graphs. Methods which can be implemented by computer algorithms.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Groups:** Advanced Mathematics Courses



**MATH 471 Introduction to Topology**

**Prerequisites:** MATH 314 or MATH 314H; and 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 495 Seminar**

**Prerequisites:** MATH 208 or 208H; and permission.

**Credit Hours:** 1-3

**Min credits per semester:** 1

**Max credits per semester:** 3

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**Groups:** Seminars, Ind Study, Topics

**MATH 496 Seminar in Mathematics**

**Crosslisted with:** MATH 896

**Prerequisites:** Permission.

**Description:** Topics in one or more branches of mathematics.

**Credit Hours:** 0-4

**Min credits per semester:**

**Max credits per semester:** 4

**Max credits per degree:** 13

**Grading Option:** Graded with Option

**Groups:** Seminars, Ind Study, Topics

**MATH 497 Reading Course**

**Prerequisites:** Permission.

**Credit Hours:** 1-4

**Min credits per semester:** 1

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Graded with Option

**Groups:** Seminars, Ind Study, Topics

**PLEASE NOTE**

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

## Mathematics (B.A.) Mathematics - sTANDARD (B.S.) Career Information

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

**Transferable Skills**

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

**Jobs of Recent Graduates**

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

**Internships**

- Data Science Intern, The Hartford Insurance Company - Hartford CT
- Actuarial Intern, Lincoln Financial Group - Omaha NE

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

## Graduate & Professional Schools

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