

MATHEMATICS

Description

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

Options in the Major

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

Standard Option

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

Discrete Mathematics and Cryptography Option

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

Education Option

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

Mathematical Biology Option

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

Mathematical Finance Option

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

Mathematics of Physical Phenomena Option

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

Statistics and Data Science Option

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

Learning Outcomes

Graduates with a major in mathematics will:

1. Reason quantitatively using numeric, algebraic, and analytic methods.
2. Understand, analyze, create, and discover mathematical arguments organized by means of definitions, results, proofs, and examples.
3. Apply critical and precise mathematical thinking to model, formulate, and solve problems in interdisciplinary or practical settings.

4. Communicate mathematical ideas, both in writing and orally, to varied audiences, including formal reasoning and applications of mathematics.

Graduates with the standard option will also be able to:

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

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

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

Graduates with the education option will also be able to:

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

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

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

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

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

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

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

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

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

Academic and Career Advising

Academic and Career Advising Center

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

are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

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

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

Assigned Academic Advisors

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

Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, visit <https://cas.unl.edu/major-advisors> (<https://cas.unl.edu/major-advisors/>), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, casadvising@unl.edu.

Career Coaching

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

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

ACE Requirements

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in

the degree audit, or visit the ACE (<http://ace.unl.edu>) website (<http://ace.unl.edu>) for the most current list of certified courses.

ACE Student Learning Outcomes

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

The College of Arts and Sciences distribution requirements are designed to ensure a range of courses across disciplines within the College. Students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Internship (395 or 495), independent study or readings (396 or 496), research (398 or 498), and thesis (399, 399H, 499, or 499H) will not satisfy distribution requirements.
- Other courses with a 9 in the middle number (ex. PSYC 292) will not satisfy distribution requirements unless approved by an advisor.
- Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the lead department.

CDR: Written Communication

Select from courses approved for ACE outcome 1.

CDR: Natural, Physical, and Mathematical Sciences¹

Select a course from ASTR, BIOS, CHEM, GEOL, LIFE, METR, MATH, PHYS, or ANTH 242, GEOG 155, GEOG 281, POLS 250, or PSYC 273.

CDR: Laboratory²

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

CDR: Humanities³

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

CDR: Social Science⁴

Select a course from ANTH, COMM, GEOG, NSST, POLS, PSYC, or SOCI.

CDR: Human Diversity in U.S. Communities

Select from the following approved courses also listed in your degree audit: ANTH 130, ANTH 412, ANTH 447, ANTH 473, ARAB/RELG 313, COMM 311, COMM 315, COMM/ETHN 335, COMM 364, COMM/ETHN 365, COMM 465, ENGL/WMNS 212, ENGL/ETHN 245N, ENGL/WMNS 312, ENGL/ETHN 345D, ENGL/ETHN/WMNS 345N, ENGL/ETHN 346, ENGL 376, ENGL 380, ENGL/ETHN 445, ETHN 100, ETHN 201, ETHN 202, ETHN 204, ETHN 484, FILM/ETHN 344, GEOG 271, GEOG 403, GLST/ANTH/MODL 214, GLST 350, HIST/ETHN/WMNS 115, HIST/ETHN 234, HIST/ETHN 246, HIST 251, HIST/ETHN 340, HIST 351/ETHN 341, HIST/ETHN/WMNS 356, HIST/ETHN 357, HIST/WMNS 402, HRHA 350, MODL 260, PHIL 105, PHIL 106, PHIL/WMNS 218, PHIL 323, PHIL 325, POLS/ETHN 333, POLS/WMNS 338, POLS 340, POLS 347, POLS 433, PSYC/ETHN 310, PSYC 330, PSYC/WMNS 421, PSYC/ETHN 425, RELG/HIST 134, RELG/ETHN/HIST 226, RELG/HIST 227, SOCI 101, SOCI 180, SOCI/WMNS 200, SOCI/ETHN 217, SPAN 206, SPAN 486, WMNS 101, WMNS 201, WMNS 202, WMNS 210

CDR: Language

BA Students⁵

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

BS Students⁶

Fulfilled by the completion of the 2nd level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

ENGL 180, or ENGL 200 level and above. Excluded courses: CLAS 116, ENGL 254, ENGL 300, ENGL 354, SPAN 300A, SPAN 303, and SPAN 304.

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

⁵ ARAB 202, CHIN 202, CZEC 202, FREN 202 or FREN 210, GERM 202, GREK 301 and GREK 302, JAPN 201 and JAPN 202, LATN 301 and LATN 302, SPAN 202 or SPAN 210 or SPAN 300A or SLPA 202.

⁶ ARAB 102, CHIN 102, CZEC 102, FREN 102, GERM 102, GREK 102 or GREK 151, JAPN 102, LATN 102, SPAN 102 or SPAN 110 or SPAN 300A, or SLPA 102.

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 is successful completion of two levels of the same world language, and the College of Arts and Sciences degree requirement (CDR: Language) is proficiency through 4 levels for BA students, or 2 levels for BS students. Levels are defined as years in High School, or semesters in college as documented on an official transcript.

Students who believe they are proficient in a language, but who do not have academic records of that proficiency, should consult with their academic advisor to explore alternative assessments which may include a proficiency examination by a UNL faculty member for languages taught at UNL, or through an approved private service for languages not taught at UNL (expenses for this service would be the student's responsibility.)

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. Students should consult their assigned Academic Advisor and Career Coach for assistance identifying experiential learning opportunities relevant to their academic program, interests and goals.

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

Excluded courses include: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, MBIO 101, PHYS 201 as well as any course numbered 395, 495, 399, 399H, 499, or 499H. MATH subject area credit at the 100 level or below is also excluded.

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.

¹ Excluded courses: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MBIO 101, PHYS 201, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, and MATH subject area credit at the 100 level or below.

² ANTH 242L, ASTR 224, BIOS 101L, BIOS 110L, BIOS 111, BIOS 116, BIOS 213L, BIOS 214, CHEM 105L, CHEM 106L, CHEM 109L, CHEM 110L, CHEM 113L, GEOG 155, GEOL 101, GEOL 103, LIFE 120L, LIFE 121L, METR 100, PHYS 141, PHYS 142, PHYS 153, PHYS 221, or PHYS 222.

³ ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, and SPAN courses must be numbered 300 or above. ENGL courses must be ENGL 170,

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

University policy for the Pass/No Pass (P/N) privilege:

- Neither the P nor the N grade factor into your GPA.
- 'P' is interpreted to mean a grade of C or above. A grade of C- or lower results in a "N".
- A change to or from a Pass/No Pass may be made until mid-term (1/2 of the course - see the academic calendar for specific dates per term).
- The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University policy governing the grading options.
- Changing to or from the Pass/No Pass grading option requires using MyRED, or processing a Schedule Adjustment Form.
- For undergraduates, the University maximum of 24 'Pass' credit hours and/or college and department limits will apply. These limits do not include courses offered on a 'Pass/No Pass' basis only. Consult your advisor or the Undergraduate Catalog (<https://catalog.unl.edu/undergraduate/>) for restrictions on the number of 'Pass' hours you can apply toward your degree.
- The 'Pass/No Pass' grading option cannot be used for the removal of 'C-', 'D+', 'D', 'D-', or 'F' grade factors.

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

College of Arts and Sciences policy on the Pass/No Pass (P/N) privilege:

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

Grading Appeals

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

- Talk with the instructor concerned. Most problems are resolved at this point.
- Talk to the instructor's department chairperson.

- Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
- Take the case to the College Grading Appeals Committee by contacting the Dean's Office, 1223 Oldfather Hall.

Course Level Requirements

Courses Numbered at the 300 or 400 Level

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

Residency Requirement

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

Catalog to Use

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

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

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.		28-43
Credit Hours Subtotal:		28-43

Total Credit Hours	40-55
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Standard Option

Required Courses

MATH 208	Calculus III	4
MATH 221	Differential Equations	3
or STAT 380	Statistics and Applications	
MATH 309	Introduction to Mathematical Proofs	3
MATH 310	Introduction to Modern Algebra	3
MATH 325	Elementary Analysis	3
Credit Hours Subtotal:		16

Additional MATH Courses ¹

Select four additional advanced MATH courses at the 300 or 400 level with at least two at the 400 level.

Credit Hours Subtotal:		12
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Minor, 2nd Major, or Research Experience

Students pursuing the Standard Option must accompany the math major with a minor or a 2nd major. An approved significant research experience including thesis, UCARE, or REU may be used.

Total Credit Hours		28
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¹ MATH 221 may apply, but the following courses are excluded: MATH 300, MATH 301, MATH 302, MATH 315, MATH 391, MATH 394, MATH 398, 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:

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

Credit Hours Subtotal:		9
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Computer Science Courses

CSCE 155T	Computer Science I: Informatics Focus	3-4
or CSCE 155A	Computer Science I	
or CSCE 155E	Computer Science I: Systems Engineering Focus	
or CSCE 155H	Honors: Computer Science I	
or CSCE 155N	Computer Science I: Engineering and Science Focus	
or CSCE 183H / Honors: Computer Problem Solving Essentials	RAIK 183H	
CSCE 311	Data Structures and Algorithms for Informatics	3-4
or CSCE 310	Data Structures and Algorithms	

or SOFT 260H / Honors: Software Engineering III
RAIK 283H

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 377	Fundamentals of Cybersecurity	

Credit Hours Subtotal: 12-14

Total Credit Hours 30-33

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 advanced MATH course at the 400 level. ¹

Credit Hours Subtotal:		3
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An education major or minor

Students pursuing the Education Option should accompany the Mathematics major with a 2nd major in Elementary, Secondary, or Special Education, through dual matriculation or intercollege study with the College of Education and Human Sciences. An Education Studies minor may also be used to meet this requirement. ²

Credit Hours Subtotal: 18

Total Credit Hours 43

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

² Majors include Elementary Education & Special Education, Elementary Education, Elementary Education & Early Childhood Education, Secondary Education, or Special Education (7-12 or K-6).

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 & 120L Fundamentals of Biology I and Fundamentals of Biology I laboratory	4
LIFE 121 & 121L Fundamentals of Biology II and Fundamentals of Biology II Laboratory	4
Select one of the following sequences:	7-8
BIOS 201 & BIOS 337 General Genetics and Applications of Bioinformatics	
BIOS 201 & BIOS 426 General Genetics and Systems Biology	
BIOS 201 & 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
MATH 309	Introduction to Mathematical Proofs	3
or MATH 310	Introduction to Modern Algebra	
MATH 325	Elementary Analysis	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
One additional advanced MATH course at the 400 level. ¹		3
Credit Hours Subtotal:		25-26
Actuarial Science and Finance Courses		
ACTS 440	Interest Theory	3
FINA 367	Fixed Income Investments	3
FINA 467	Options, Futures and Derivative Securities	3
Credit Hours Subtotal:		9
Total Credit Hours		34-35

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

Mathematics of Physical Phenomena Option

Required Courses

MATH 208	Calculus III	4
MATH 221	Differential Equations	3
MATH 309	Introduction to Mathematical Proofs	3

MATH 325	Elementary Analysis	3
Credit Hours Subtotal:		13

Additional Mathematics Courses

Select two additional advanced MATH courses at the 400 level. 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	
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 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 447	Numerical Methods for Applied Math	
MATH 487	Probability Theory	
MATH 489	Stochastic Processes	

Select one additional advanced MATH course at the 400 level.
¹

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

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

Set 1

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

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
MATH 432	Mathematics of Machine Learning

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 more than 3 hours graded 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.

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
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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 more than 3 hours of courses graded Pass/No Pass will be counted toward the major or minor.

MATH 100A Intermediate Algebra

Prerequisites: Appropriate score on the Math Placement Exam.

Notes: Credit earned in MATH 100A will not count toward degree requirements.

Description: Review of the topics in a second-year high school algebra course taught at the college level. Includes: real numbers, 1st and 2nd degree equations and inequalities, linear systems, polynomials and rational expressions, exponents and radicals. Heavy emphasis on problem solving strategies and techniques.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: MATH 101; MATH 103

Course and Laboratory Fee: \$10

MATH 101 College Algebra

Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A. Credit toward the degree may only be earned in one of MATH 101, MATH 101P, or MATH 103.

Notes: 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 101P College Algebra Plus Foundations

Prerequisites: Appropriate score on the Math Placement Exam. Credit toward the degree may only be earned in one of MATH 101, MATH 101P, or MATH 103.

Notes: Students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.

Description: College Algebra topics including: real numbers, exponents, factoring, linear and quadratic equations, absolute value, inequalities, functions, graphing, polynomial and rational functions, exponential and logarithmic functions, system of equations. Also includes necessary background Intermediate Algebra topics: 1st and 2nd degree equations and inequalities, linear systems, rational expressions, exponents and radicals. Heavy emphasis on problem solving strategies and techniques.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL

Prerequisite for: MATH 102; MATH 104

MATH 102 Trigonometry

Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101 or MATH 101P. Credit toward the degree may only be earned in one of MATH 102 or MATH 103.

Notes: 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; PLAS 458, AGRO 858, NRES 458, NRES 858, SOIL 458; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472

Course and Laboratory Fee: \$10

MATH 103 College Algebra and Trigonometry

Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A. Credit toward the degree cannot be earned in MATH 103 and any of MATH 101, MATH 101P, or MATH 102.

Notes: Students with previous credit in any calculus course (Math 104, 106, 107, or 208) may not earn credit for this course.

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

Credit Hours: 5

Max credits per semester: 5

Max credits per degree: 5

Grading Option: Graded with Option

Prerequisite for: AGST 109; CHEM 105A; CHEM 109A; CHEM 113A; CHME 204; CRIM 300; CSCE 155A; CSCE 155E; ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; GEOL 200; MATH 104; MATH 106; METR 100; METR 140; PHYS 141; PHYS 141H; PHYS 151; PLAS 361, GEOL 361, NRES 361, SOIL 361; PLAS 458, AGRO 858, NRES 458, NRES 858, SOIL 458; 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. Credit toward the degree may be earned in only one of MATH 106 or MATH 104

Notes: 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: ACCT 308; ACCT 309; AECN 340; AECN 465, AECN 865, NREE 465; AGST 109; ARCH 333, CNST 305; 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 315; METR 100; METR 140; MRKT 341H, RAIK 341H; PHYS 151; PLAS 361, GEOL 361, NRES 361, SOIL 361; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472; SCMA 331; SCMA 335; SCMA 350; SCMA 350H

ACE: ACE 3 Math/Stat/Reasoning

Course and Laboratory Fee: \$10

MATH 106 Calculus I

Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 102 or MATH 103. Credit toward the degree may be earned in only one of MATH 106 or MATH 104

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: ACCT 308; ACCT 309; AGEN 112, BSEN 112; AGEN 225, BSEN 225; AGST 109; ARCH 333, CNST 305; 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 155E, ECEN 155E; 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; MATH 315; MECH 220; METR 100; METR 140; METR 205; MRKT 341H, RAIK 341H; PHYS 141; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PLAS 361, GEOL 361, NRES 361, SOIL 361; PLAS 472, AGRO 872, NRES 472, NRES 872, SOIL 472; SCMA 331; SCMA 335; SCMA 350; SCMA 350H

ACE: ACE 3 Math/Stat/Reasoning

Course and Laboratory Fee: \$10

MATH 107 Calculus II

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

Description: Integration theory; techniques of integration; applications of definite integrals; sequences and series; convergence of series; power series; Taylor series and their applications.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: ACCT 308; ACCT 309; AREN 211; ASTR 204; BIOC 440; 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 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 314; MATH 314H; MECH 223; MECH 223H; METR 100; METR 140; METR 223; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PHYS 212H; PLAS 361, GEOL 361, NRES 361, SOIL 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; 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. Credit toward the degree cannot be earned in MATH 107 and MATH 107H.

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: ACCT 308; ACCT 309; AREN 211; ASTR 204; BIOC 440; 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 314; MATH 314H; MECH 223; MECH 223H; METR 100; METR 140; METR 223; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211; PHYS 211H; PHYS 212; PHYS 212H; PLAS 361, GEOL 361, NRES 361, SOIL 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; 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:** ACCT 308; ACCT 309; ASTR 204; 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 311A; ECON 311B; ECON 312A; ECON 312B; FINA 361; FINA 361A; FINA 361H; MATH 107; MATH 208; MATH 221; MATH 221H; MATH 314; MECH 223; METR 100; METR 140; METR 223; MRKT 341H, RAIK 341H; PHYS 141H; PHYS 151; PHYS 211H; PHYS 212; PLAS 361, GEOL 361, NRES 361, SOIL 361; SCMA 331; SCMA 335; SCMA 350; SCMA 350H**MATH 191 Special Topics in Mathematics****Description:** Topics vary.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded with Option**Prerequisite for:** METR 100; METR 140**MATH 203 Contemporary Mathematics****Notes:** Credit toward the degree cannot be earned in both MATH 203 and MATH 203J.**Description:** Applications of quantitative reasoning and methods to problems and decision making in the areas of management, statistics, and social choice. Includes networks, critical paths, linear programming, sampling, central tendency, inference, voting methods, power index, game theory, and fair division problems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 3 Math/Stat/Reasoning**MATH 208 Calculus III****Prerequisites:** A grade of P, C or better in MATH 107**Description:** Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green's Theorem, and applications.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** ACCT 308; ACCT 309; ACTS 445; ASTR 204; BLAW 371H; BLAW 372; BLAW 372H; CHME 114; CHME 202; CHME 332; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; CSCE 156H; ECEN 305; ECEN 306; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MECH 223H; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; METR 311; 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. Credit toward the degree cannot be earned in MATH 208 and MATH 208H.**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:** ACCT 308; ACCT 309; ACTS 445; ASTR 204; BLAW 371H; BLAW 372; BLAW 372H; CHME 114; CHME 202; CHME 332; CSCE 155A; CSCE 155E, ECEN 155E; CSCE 155H; CSCE 155N; CSCE 155T; CSCE 156, ECEN 156; CSCE 156H; ECEN 305; ECEN 306; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ENVE 210; FINA 361; FINA 361A; FINA 361H; MATH 208; MATH 221; MATH 314; MECH 223H; MECH 318; MECH 321; MECH 325; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; METR 311; 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 215; ECEN 216; ECEN 304; ECEN 306; ENGR 410; MATH 430; 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. Credit toward the degree cannot be earned in MATH 221 and MATH 221H.

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 215; ECEN 216; ECEN 304; ECEN 306; ENGR 410; MATH 430; 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 310; MATH 325; MATH 398; 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 309

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 398; 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. Credit toward the degree may be earned in only one of the following: MATH 314 or MATH 314H or MATH 315.

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; ECEN 215; MATH 430; MATH 432; 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. Credit toward the degree may be earned in only one of the following: MATH 314 or MATH 314H or MATH 315.

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: ECEN 215; MATH 430; MATH 432; MECH 350; STAT 871

MATH 315 Linear Algebra for Data Science

Prerequisites: A grade of P, C, or better in MATH 104 or MATH 106. Credit toward the degree may be earned in only one of the following: MATH 314 or MATH 314H or MATH 315.

Notes: 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

Prerequisite for: MATH 432

MATH 325 Elementary Analysis

Prerequisites: A grade of P, C, or better in MATH 309 or MATH 310.

Description: An introduction to mathematical reasoning, construction of proofs, and careful mathematical writing in the context of continuous mathematics and calculus. Topics may include the real number system, limits and continuity, the derivative, integration, and compactness in terms of the real number system.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: MATH 398; 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 398 Research Experience in Mathematics

Prerequisites: MATH 309, MATH 310, or MATH 325

Description: An introduction to open, unsolved problems in pure and applied mathematics. Development of foundational understanding necessary to approach open problems. Engagement in data collection, forming hypotheses, problem solving, and other creative aspects of mathematical research. Discussion about how to find and read existing mathematical research papers, and emphasis on effective mathematical writing and communication.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option

Experiential Learning: Research

MATH 399 Undergraduate Thesis

Prerequisites: Permission.

Description: Independent research leading to an undergraduate thesis.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option

MATH 399H Honors Undergraduate Thesis

Prerequisites: Permission. Credit toward the degree cannot be earned in both MATH 399 and MATH 399H.

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 432 Mathematics of Machine Learning

Prerequisites: A grade of P, C, or better in MATH 314 or MATH 315

Description: An introduction to the essential mathematical content necessary to understand machine learning, its opportunities, and its challenges. Differentiation in higher dimensions, gradient descent method, optimization over convex and non-convex domains, neural networks, and computer implementation of machine learning algorithms to solve benchmark problems.

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:** Data Science Major or Mathematics Major; Senior Standing**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. Credit toward the degree may be earned in only one of the following: CSCE440/MATH 440 and MECH 480**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

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 I, Omaha National – Omaha, NE
- Formulation Engineer, Syngenta – Greensboro, NC
- Lab Technician, Nebraska Department of Transportation – Lincoln, NE
- Institutional Research Analyst, Northeast Community College – Norfolk, NE
- Client Implementations Technology Analyst, Fiserv – Lincoln, NE
- Associate Application Developer, Union Pacific – Omaha, NE

Internships

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

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