MATHEMATICS

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

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

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

College Requirements

College Admission

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

In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language. 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.

Transfer Students
To be considered for admission as a transfer student, Nebraska resident or nonresident, students must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who graduated from high school January 1997 and after must also meet the UNL General Admission Requirements. Those transfer students who graduated before January 1997 must have completed in high school 3 years of English, 2 years of the same foreign language, 2 years of algebra, and 1 year of geometry. Transfer students who have completed less than 12 credit hours of college study must also submit either their ACT or SAT scores.

Ordinarily, hours earned at a similarly accredited college or university are applicable to the UNL degree. The College, however, will evaluate all hours submitted on an application for transfer, and reserves the right to accept or reject any of them, based upon its exclusion and restriction policies. Sixty is the maximum number of hours the University will accept on transfer from a two-year college or international institution. Transfer credit in the major or minor must be approved by the departmental advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major or minor. At least half of the hours in the major field must be completed at the University regardless of the number of hours transferred.

The College of Arts and Sciences will accept no more than 15 semester hours of C- and D grades from other schools. The C- and D grades cannot be applied toward requirements for a major or minor. This policy does not apply to the transfer of grades from UNO or UNK to UNL. All D grades may be transferred from UNO or UNK, but they are not applicable to a major or minor.

Readmitted Students
UNL students who choose not to take courses for more than 2 consecutive terms, must reapply to UNL. Students readmitted to the College of Arts and Sciences will follow the requirements stated in the catalog for the academic year of readmission and re-enrollment as a degree-seeking student in Arts and Sciences. In consultation with advisors, a student may choose to follow a 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.

Admission Deficiencies/Removal of Deficiencies
Students must remove entrance deficiencies in geometry and foreign language as soon as possible, and before graduating from the College of Arts and Sciences. For questions and more information, students should consult a college advisor in the Academic and Career Advising Center in 107 Oldfather Hall.

Removing Foreign Language Deficiencies
Students must complete the second semester of a first year language sequence to clear the deficiency and the second semester of the second year language sequence to complete the college graduation requirement in language.

Removing Geometry Deficiencies
A deficiency of one year of geometry can be removed by taking high school geometry courses through an approved independent study program, or by completing a geometry course from an accredited community college or a four-year institution. Neither of these options will count for college credit.

College Degree Requirements

College Distribution Requirements
Bachelor of Arts or Bachelor of Science (16 hours + Language)
The College of Arts and Sciences distribution requirements are designed to further the purposes of liberal education by encouraging study in several different areas within the College. All requirements are in addition to University ACE requirements. A student may not use a single course to satisfy more than one of the following five distribution requirements. A student cannot use a single course to satisfy both an ACE outcome and a College distribution requirement. A student cannot use a course from their primary major to satisfy the Breadth Requirement (F), but may apply an ancillary requirement of the primary major or a course from their second major toward this requirement. Independent study or reading courses and internships cannot be used to satisfy distribution requirements. To see a complete list of excluded courses, run a degree audit through MyRED.

Courses from interdisciplinary programs will count in the same area as courses from the home/cross-listed department(s).
**College Distribution Requirements**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CDR A - Written Communication</strong></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>CDR B and BL - Natural, Physical, and Mathematical Sciences with Lab</strong></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td><strong>CDR C - Humanities</strong></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>CDR D - Social Science</strong></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>CDR E - Language</strong></td>
<td></td>
<td>0-16</td>
</tr>
</tbody>
</table>

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, modern languages and literatures, or anthropology. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Omaha, 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.

**CDR F - Additional Breadth**

Select from: natural, physical and mathematical sciences (Area B), humanities (Area C), or social sciences (Area D). Cannot be a course from the primary major.

Credit Hours Subtotal: 16-32

1. See degree audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.
2. Language courses numbered 210 or below apply only for the foreign language requirement.
3. See degree audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

**Scientific Base**

**Bachelor of Science Only (60 hours)**

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

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

**Foreign Languages/Language Requirement**

**Languages Exemption Policy**

UNL and the College of Arts and Sciences will exempt or waive students from the UNL entrance requirement of two years of the same foreign language or from the College’s language distribution requirement based on documentation only. The following are the options and procedures for documentation:

**High School Transcripts**

For the University entrance requirement, students must show an official high school transcript with two or more years of the same foreign language.

For the College of Arts and Sciences College Distribution Requirement E-Language, students must show an official high school transcript with four or more years of the same foreign language in high school, or show evidence of graduation from a non-English-speaking foreign high school. Students whose native language is not English must show English as a Second Language study on an official high school transcript. Four years of ESL at the high school level (9th, 10th, 11th and 12th grades) will be the basis for a waiver of the CDR E Language requirement.

**Proficiency Examination at UNL**

For the University entrance requirement, students who do not have transcript documentation can request to take a proficiency exam in the language. (This is not the same test as the Modern Languages Placement Exam.) However, UNL will provide testing only in the languages it teaches. Currently, these languages are: Arabic, French, German, Spanish, Russian, Czech, Japanese, Chinese.

For the College of Arts and Sciences College Distribution Requirement E-Language, the Department of Modern Languages will oversee the test at the 202 level. If the student passes the test, the department will sign the College Request for Waiver form and indicate the level of proficiency. The form is then forwarded to the Arts and Sciences Advising Center for approval.

The Department of Modern Languages will oversee the test and provide written documentation to the Arts and Sciences Advising Center the level of proficiency passed.

**Distance Education**

For the University entrance requirement, students without transcript documentation who claim proficiency in a language not taught at UNL, have the option of seeking out a distance education program in languages. If the student completes the equivalent of 102 from an approved distance education program, the student will meet the UNL entrance requirement. The student must have the course work approved before he/she takes/completes the course as equivalent to 102 by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.

For the College of Arts and Sciences College Distribution Requirement E-Language, the student can seek out a distance education program and complete the equivalent of the 202-level course. The student must submit the request on the College Request for Substitution form and have the course work approved by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.
**Third Language Option**
If a student demonstrates knowledge of two foreign languages at the 102 level, the College of Arts and Sciences may consider waiving two semesters of the four semester College Distribution Requirement E-Languages requirement. If this waiver were granted, the student would then be required to complete 101 and 102 in another, 3rd foreign language at UNL.

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

**Grade Rules**

**Restrictions on C- and D Grades**
The College will accept no more than 15 semester hours of C- and D grades from other schools except for UNO and UNK. No transfer 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.

**Pass/No Pass Privilege**

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

1. The Pass/No Pass option is designed for your use by seeking to expand your intellectual horizons by taking courses in areas where you may have had minimal preparation.
2. Neither the P nor the N grade contribute to your GPA.
3. P is interpreted to mean C or above.
4. A change to or from a Pass/No Pass may be made until mid-term (see academic calendar for specific dates per term).
5. The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University governing the grading option.
6. Changing to or from Pass/No Pass requires using the MyRED system to change the grading option or filing a Drop/Add form with the Office of the University Registrar, 107 Canfield Administration Building. After mid-term of the course, a student registered for Pass/No Pass cannot change to a grade registration unless the pass/no pass registration is in conflict with the policy of the professor, department, college, or University governing Pass/No Pass.
7. The Pass/No Pass grading option cannot be used for the removal of C- or D grades.

Pass/No Pass privileges in the College of Arts and Sciences are extended to students according to the following additional regulations:

1. Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
2. 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.
3. Departments may specify that certain courses of theirs can be taken only on a P/N basis.
4. 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 above 299**
Thirty of the 120 semester hours of credit must be in courses numbered above 299. Of the 30 hours above 299, 15 hours (1/2) must be completed in residence at UNL.

**Graduate Courses**
Seniors in the University who have obtained in advance the approval of the dean for Graduate Studies may receive up to 12 hours credit for graduate courses taken in addition to the courses necessary to complete their undergraduate work, provided that such credits are earned within the calendar year prior to receipt of the baccalaureate. For procedures, inquire at the Office of Graduate Studies.

Course work taken prior to receipt of the baccalaureate may not always be accepted for transfer to other institutions as graduate work.

**Residency**

**Residency Requirement and Open Enrollment and Summer Independent Study Courses**
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 course work including 6 hours above 299 in their major, and 15 of the 30 hours required above 299 in residence. Credit earned during education abroad may be used toward the residency requirement if students register through UNL and participate in prior-approved education abroad programs. UNL open enrollment and summer independent study courses count toward residence.

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

Key characteristics of ACE demonstrate the benefits of the program to students:

- Students receive a broad education with exposure to multiple disciplines, critical life skills and important reasoning, inquiry, and civic capacities.
• ACE is simple and transparent for students, faculty and advisors. Students complete the equivalent of 3 credit hours for each of the ten student learning outcomes.
• Students connect and integrate their ACE experiences with their selected major.
• Students can transfer all ACE certified courses across colleges within the institution to meet the ACE requirement and any course from outside the institution that is directly equivalent to a UNL ACE-certified course. Courses from outside institutions without direct equivalents may be considered with appropriate documentation for ACE credit (see academic advisor).

ACE allows faculty to assess and improve their effectiveness and facilitate students’ learning.

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

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

Major Requirements
Bachelor of Science
Complete the core requirements and one of four options: Concentration, Education, Statistics, or Research.

Core Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 208</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 310</td>
<td>Introduction to Modern Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 314</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 325</td>
<td>Elementary Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>22</td>
</tr>
</tbody>
</table>

Specific Major Requirements
Select and complete one of the following options: Concentration, Education, Research, or Statistics. Under any option, students may substitute a more advanced course in the same area for a required mathematics course.

Option C (Concentration)
This option is ideal for students wishing to combine a strong mathematics education with a coherent body of coursework in another discipline.

Option C Mathematics Courses
Select one course from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 221</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 380 Statistics and Applications</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 380</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Credit Hours Subtotal:</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Any Plan A minor or an approved 18 hour concentration

Option E (Education)
This option is ideal 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.

Option E Mathematics Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 350</td>
<td>Geometry for High School Teaching</td>
<td>3</td>
</tr>
<tr>
<td>MATH 380 / STAT 380</td>
<td>Statistics and Applications</td>
<td>3</td>
</tr>
<tr>
<td>MATH 405</td>
<td>Discrete and Finite Mathematics for High School Teaching</td>
<td>3</td>
</tr>
<tr>
<td>MATH 407</td>
<td>Mathematics for High School Teaching I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 408</td>
<td>Mathematics for High School Teaching II</td>
<td>3</td>
</tr>
<tr>
<td>Credit Hours Subtotal:</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Option R (Research Experience)
This option is recommended for students interested in independent work and for students planning to pursue graduate work in mathematics.

Option R Mathematics Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 221</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Four additional advanced mathematics courses with at least three at the 400 level.</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Credit Hours Subtotal:</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

An approved undergraduate research experience

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Option S (Statistics)
This option is recommended for students interested in a mathematics major and a strong body of course work in statistics.

Option S Mathematics Courses
MATH 380 / STAT 380
Statistics and Applications
Four additional advanced mathematics courses with at least two at the 400 level.  1
Credit Hours Subtotal:  12

Statistics Courses
Select three additional statistics courses at 300 or 400 level.
Credit Hours Subtotal:  9


1 One 400-level statistics course may be substituted for one of the required two 400 level additional advanced mathematics courses, provided the course makes significant use of advanced mathematics. The faculty advisor must approve the substitution.

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

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

STAT 380
Total Credit Hours  25

Specific Major Requirements (9 hours)
Additional Advanced Mathematics Courses
Select three additional advanced mathematics courses with at least two at the 400 level.
Credit Hours Subtotal:  9
Total Credit Hours  9

Additional Major Requirements
Prerequisite Requirements/Rules
The prerequisites listed for a course may be replaced by equivalent preparation. One prerequisite for all advanced mathematics courses is successful completion of MATH 106, MATH 107, MATH 208. Two courses past calculus are required prerequisites for all 400-level mathematics courses. All topics, independent study, reading courses and seminars require permission of the instructor before registering; and these courses do not count toward the major requirements unless approved by the faculty advisor.

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

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

Requirements for Minor Offered by Department
Plan A Minor (19 hours)
A complete calculus sequence plus two advanced mathematics courses.

MATH 106  Calculus I  5
MATH 107  Calculus II  4
MATH 208  Calculus III  4
Two advanced mathematics courses  6
Total Credit Hours  19

Plan B Minor (13 hours)
A complete calculus sequence.

MATH 106  Calculus I  5
MATH 107  Calculus II  4
MATH 208  Calculus III  4
Total Credit Hours  13

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

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

MATH 100A Intermediate Algebra
Prerequisites: One year high school algebra and appropriate score on the Math Placement Exam
Notes: Credit earned in MATH 100A will not count toward degree requirements.
Description: Review of the topics in a second-year high school algebra course taught at the college level. Includes: real numbers, 1st and 2nd degree equations and inequalities, linear systems, polynomials and rational expressions, exponents and radicals. Heavy emphasis on problem solving strategies and techniques.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 100A, MATH 101; MATH 103
Groups: Introductory Mathematics
MATH 101 College Algebra
Prerequisites: Appropriate placement exam score and either two years of high school algebra or a grade of P, C, or better in MATH 100A
Notes: Credit for both MATH 101 and 103 is not allowed.
Description: Real numbers, exponents, factoring, linear and quadratic equations, absolute value, inequalities, functions, graphing, polynomial and rational functions, exponential and logarithmic functions, system of equations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CRIM 300; MATH 101; MATH 102; MATH 104; METR 100
Groups: Introductory Mathematics

MATH 102 Trigonometry
Prerequisites: One year high school geometry and either two years high school algebra, one semester high school precalculus, and a qualifying score on the Math Placement Exam; or a grade of C, P, or better in MATH 101
Notes: Credit toward the degree may be earned in only one of MATH 102 or 103.
Description: Trigonometric functions, identities, trigonometric equations, solution of triangles, inverse trigonometric functions and graphs.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC
Prerequisite for: AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; ASCI 340; MATH 102; MATH 104; MATH 106; METR 100
Groups: Introductory Mathematics

MATH 103 College Algebra and Trigonometry
Prerequisites: Appropriate placement exam score, one year high school geometry, and two years high school algebra. For students with previous college math courses, permission is also required
Notes: For students with previous college math courses, permission is also required.
Description: First and second degree equations and inequalities, absolute value, functions, polynomial and rational functions, exponential and logarithmic functions, trigonometric functions and identities, laws of sines and cosines, applications, polar coordinates, systems of equations, graphing, conic sections.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; MATH 103; MATH 104; MATH 106; METR 100
Groups: Introductory Mathematics

MATH 104 Applied Calculus
Prerequisites: Appropriate placement exam score or a grade of P (pass), or C or better in MATH 101
Notes: Credit for both MATH 104 and 106 is not allowed.
Description: Rudiments of differential and integral calculus with applications to problems from business, economics, and social sciences.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 308; ACCT 309; ACCT 313; 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; BLAW 371; BLAW 371H; BLAW 372; BSEN 355; ECON 215; ECON 215H; ECON 311; FINA 361; FINA 361H; FORS 411; MATH 104; METR 100; MNGT 301; MNGT 301H; MRKT 341H, RAJK 341H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 106 Calculus I
Prerequisites: One year high school geometry; two years algebra and one year precalculus-trigonometry in high school or MATH 102 or Math 103 or equivalent
Notes: Credit for both MATH 104 and Math 106 is not allowed. Math Placement Policy applies.
Description: Functions of one variable, limits, differentiation, exponential, trigonometric and inverse trigonometric functions, maximum-minimum, and basic integration theory (Riemann sums) with some applications.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 308; ACCT 309; ACCT 313; 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; BLAW 371; BLAW 371H; BLAW 372; BSEN 355; CHME 114; CNST 241; CNST 252; CNST 306; CSCE 235, CSCE 235H; ECON 215; ECON 215H; ECON 311; FINA 361; FINA 361H; FORS 411; MATH 106; MATH 107; MATH 107H; METR 100; MNGT 301; MNGT 301H; MRKT 341H, RAJK 341H; 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
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ASTR 204; BLAW 371; BLAW 371H; BLAW 372; CHME 202; CHME 331; ECEN 211; ECEN 224; ECON 215; ECON 311; FINA 361; FINA 361H; MATH 107; MATH 208; MATH 380, MATH 380H, STAT 380, STAT 380H, RAJK 270H; MECH 223; METR 100; METR 223; MNGT 301; MNGT 301H; MRKT 341H, RAJK 341H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics
MATH 107H Honors: Calculus II
Prerequisites: Good standing in the University Honors Program or by invitation; and a grade of "B" or better in MATH 106 or equivalent
Description: For course description, see MATH 107.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; BLAW 371; BLAW 371H; CHME 202; CHME 331; ECEN 211; ECEN 224; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 380; MATH 380H, STAT 380, STAT 380H, RAIK 270H; MECH 223; METR 100; METR 223; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
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
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ASTR 204; BLAW 371; BLAW 371H; BLAW 372; CHME 202; CHME 331; ECEN 211; ECEN 224; ECON 311; FINA 361; FINA 361H; MATH 107; MATH 208; MECH 223; METR 100; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 189H University Honors Seminar
Prerequisites: Good standing in the University Honors Program or by invitation; 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
Format: LEC
Prerequisite for: METR 100
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

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

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

MATH 208 Calculus III
Prerequisites: A grade of P, C or better in MATH 107
Description: Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green’s Theorem, and applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACTS 401; BLAW 371; BLAW 371H; BLAW 372; ECEN 215; ECEN 306; ECEN 328; ECON 311; FINA 361; FINA 361H; MATH 208; MATH 310; MATH 325; MATH 435; MECH 321; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821, ENGR 421; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics
MATH 208H Honors: Calculus III  
**Prerequisites:** Good standing in the University Honors Program or by invitation  
**Description:** Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green’s Theorem, and applications.  
**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC  
**Prerequisite for:** ABUS 341, MRKT 341; ACTS 401; BLAW 371; BLAW 371H; BLAW 372; ECEN 215; ECEN 306; ECEN 328; ECON 311; FINA 361; FINA 361H; MATH 208, MATH 310; MATH 325; MATH 435; MECH 321; MECH 325H; MECH 373; MECH 421, MECH 821, ENGR 421; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462  
**ACE:** ACE 3 Math/Stat/Reasoning  
**Groups:** Introductory Mathematics  

MATH 221 Differential Equations  
**Crosslisted with:** MATH 821  
**Prerequisites:** A grade of P or C; or better in MATH 208/208H  
**Description:** First- and second-order methods for ordinary differential equations including: separable, linear, Laplace transforms, linear systems, and some applications.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** AGES 344, BSEN 344; AGEN 957, BSEN 957, CIVE 957, GEOL 957; BSEN 311; BSEN 317; BSEN 326, CIVE 326; CHME 835; CIVE 310; CIVE 310H; ECEN 213; ECEN 216; ECEN 304; ECEN 306; ECEN 328; MATH 430; MATH 442; MECH 310, MECH 310H; MECH 381; MECH 925; MECH 933; MECH 936; MECH 938; METR 312  
**ACE:** ACE 3 Math/Stat/Reasoning  
**Groups:** Advanced Mathematics Courses  

MATH 221H Honors: Differential Equations  
**Prerequisites:** Good standing in the University Honors Program or by invitation  
**Description:** For course description, see MATH 221/821.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** AGES 344, BSEN 344; AGEN 957, BSEN 957, CIVE 957, GEOL 957; BSEN 311; BSEN 317; BSEN 326, CIVE 326; CHME 835; CIVE 310; CIVE 310H; ECEN 213; ECEN 216; ECEN 304; ECEN 306; ECEN 328; MATH 430; MATH 442; MECH 310, MECH 310H  
**ACE:** ACE 3 Math/Stat/Reasoning  
**Groups:** Advanced Mathematics Courses  

MATH 238 Mathematical Methods for Biology and Medicine  
**Crosslisted with:** MATH 838  
**Prerequisites:** Grade of P, C, or better in MATH 106/106B or MATH 108H.  
**Notes:** MATH 838 will not count toward a MA or MS degree in MATH or STAT. Some computation and visualizations in MATH 238/838 will be done with Matlab.  
**Description:** Mathematical modeling, discrete and continuous probability, parameter estimation, discrete and continuous dynamical systems, and Markov chains. Application of mathematical models in the life sciences. Methods include regression analysis, cobweb diagrams, the phase line, nullcline analysis, eigenvalue analysis, linearization, and likelihood analysis. Applications include fisheries, stage-structured populations, pharmacokinetics, epidemiology, and medical testing.  
**Credit Hours:** 5  
**Max credits per semester:** 5  
**Max credits per degree:** 5  
**Format:** LEC  
**Groups:** Advanced Mathematics Courses  

MATH 300 Mathematics Matters  
**Prerequisites:** Parallel TEAC 308 or Parallel TEAC 416D; admission to the College of Education and Human Sciences; removal of any mathematics entrance deficiencies.  
**Notes:** Credit toward the degree may be earned in only one of: MATH 300 or MATH 300M. MATH 300 is designed for elementary education majors with mathematics as an area of concentration.  
**Description:** Numbers and operations. Develop an understanding of mathematics taught in the elementary school.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** TEAC 308  
**Groups:** Introductory Mathematics  

MATH 300M Mathematics as a Second Language  
**Prerequisites:** Admission to the College of Education and Human Sciences.  
**Notes:** MATH 300M is open only to a middle grades teaching endorsement program student. Credit towards degree may be earned in only one of: MATH 300, or MATH 300M. MATH 300M is designed to strengthen the mathematics knowledge of the middle-level mathematics teacher.  
**Description:** Develop a deeper understanding of "number and operations". The importance of careful reasoning, problem solving, and communicating mathematics, both orally and in writing. Connections with other areas of mathematics and the need for developing the "habits of mind of a mathematical thinker".  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Groups:** Introductory Mathematics
MATH 301 Geometry Matters
Prerequisites: MATH 300, with a grade of C or Pass or better.
Notes: Credit towards the degree may be earned in only one of:
MATH 301. Designed for elementary education majors with mathematics as an area of concentration.
Description: Geometry and measurement. Develop an understanding of geometry as taught in the elementary school.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

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

MATH 304 Experimentation, Conjecture, and Reasoning
Prerequisites: Admission to the College of Education and Human Sciences.
Description: How to express mathematical solutions and ideas logically and coherently in both written and oral forms in the context of problem solving. Inductive and deductive logical reasoning skills through problem solving. Present and critique logical arguments in verbal and written forms. Problem topics taken from topics nationally recommended for middle school mathematics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

MATH 306 Number Theory and Cryptology for Middle Level Teachers
Prerequisites: Admission to the College of Education and Human Sciences.
Description: Basic number theory results which are needed to understand the number theoretic RSA cryptography algorithm. Primes, properties of congruences, divisibility tests, linear Diophantine equations, linear congruences, Chinese Remainder Theorem, Wilson’s Theorem, Fermat’s Little Theorem, Euler’s Theorem, and Euler’s phi function. Integers with connections to the middle school curriculum and mathematical reasoning.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

MATH 310 Introduction to Modern Algebra
Prerequisites: MATH 208
Description: Elementary number theory, including induction, the Fundamental Theorem of Arithmetic, and modular arithmetic. Introduction to rings and fields as natural extension of the integers. Particular emphasis on the study of polynomials with coefficients in the rational, real, or complex numbers.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 350; MATH 407; MATH 408; MATH 417; MATH 430; MATH 450; MATH 452; MATH 471; MATH 809, MATH 409
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 310H Honors: Introduction to Modern Algebra
Prerequisites: Good standing in the University Honors Program or by invitation.
Description: For course description, see MATH 310.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 350; MATH 407; MATH 408; MATH 417; MATH 430; MATH 450; MATH 452; MATH 471; MATH 809, MATH 409
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 314 Linear Algebra
Crosslisted with: MATH 814
Prerequisites: MATH 208
Notes: Not open to MA or MS students in mathematics or statistics
Description: Fundamental concepts of linear algebra, including properties of matrix arithmetic, systems of linear equations, vector spaces, inner products, determinants, eigenvalues and eigenvectors, and diagonalization.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 405; MATH 442; MATH 471; MATH 809, MATH 409, MECH 350
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 314H Honors: Applied Linear Algebra (Matrix Theory)
Prerequisites: Good standing in the University Honors Program or by invitation.
Description: For course description, see MATH 314.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 405; MATH 442; MATH 471; MATH 809, MATH 409, MECH 350
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses
MATH 316 Case Studies in Theoretical Ecology
Crosslisted with: BIOS 316, NRES 316
Prerequisites: Permission.
Notes: Case studies are structured around preparation for subsequent independent research (BIOS 498 or MATH 496).
Description: Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

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

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

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

MATH 380 Statistics and Applications
Crosslisted with: MATH 380H, STAT 380, STAT 380H, RAiK 270H
Prerequisites: MATH 107 or 107H
Notes: Credit toward the degree can not be earned in STAT 218 if taken after or taken in parallel with STAT/MATH 380.
Description: Probability calculus; random variables, their probability distributions and expected values; t, F and chi-square sampling distributions; estimation; testing of hypothesis; and regression analysis with applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; BLAW 371; BLAW 371H; BLAW 372; ECEN 325; ECEN 355; ECEN 850; ECON 450; ECON 511; FINA 361; FINA 361H; MATH 809, MATH 409; MECH 343; MGMT 301; MGMT 301H; MRKT 345; MRKT 350; MRKT 446; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; SCMA 350L
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 380H Statistics and Applications
Crosslisted with: MATH 380, STAT 380, STAT 380H, RAiK 270H
Prerequisites: MATH 107 or 107H
Notes: Credit toward the degree can not be earned in STAT 218 if taken after or taken in parallel with STAT/MATH 380.
Description: Probability calculus; random variables, their probability distributions and expected values; t, F and chi-square sampling distributions; estimation; testing of hypothesis; and regression analysis with applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; BLAW 371; BLAW 371H; BLAW 372; ECEN 325; ECEN 355; ECEN 850; ECON 450; ECON 511; FINA 361; FINA 361H; MATH 809, MATH 409; MECH 343; MGMT 301; MGMT 301H; MRKT 345; MRKT 350; MRKT 446; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; SCMA 350L
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 394 Topics in Contemporary Mathematics
Prerequisites: Sophomore standing and removal of all entrance deficiencies in mathematics.
Description: Topics course for students in academic fields not requiring calculus. Emphasis on understanding and mathematical thinking rather than mechanical skills. Topic varies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 6
Format: LEC
Groups: Advanced Mathematics Courses

MATH 398 Special Topics in Mathematics
Prerequisites: Permission.
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 24
Format: LEC
Groups: Seminars, Ind Study, Topics
MATH 399 Independent Study in Mathematics
Prerequisites: Prior arrangement with and permission of individual faculty member.
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 24
Format: IND
Groups: Seminars,Ind Study, Topics

MATH 399H Honors Course
Prerequisites: For candidates for degrees with distinction, with high distinction, or with highest distinction in the College of Arts and Sciences.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 4
Format: IND
Groups: Seminars,Ind Study, Topics

MATH 405 Discrete and Finite Mathematics for High School Teaching
Prerequisites: MATH 314 or 314H recommended
Notes: Credit is not allowed for both CSCE 235 and MATH 405. NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

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

MATH 408 Mathematics for High School Teaching II
Prerequisites: MATH 310 and 350
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
Format: LEC
Groups: Advanced Mathematics Courses

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

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

MATH 417 Group Theory
Prerequisites: 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
Format: LEC

MATH 423 Complex Analysis
Crosslisted with: MATH 823
Prerequisites: Math 221 or Math 325.
Description: Complex numbers, functions of complex variables, analytic functions, complex integration, Cauchy's integral formulas, Taylor and Laurent series, calculus of residues and contour integration, conformal mappings, harmonic functions. Applications of these concepts in engineering, physical sciences, and mathematics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses
MATH 424 Introduction to Partial Differential Equations
Crosslisted with: MATH 824
Prerequisites: MATH 221
Notes: Not open to MA or MS students in mathematics or statistics.
Description: Introduction to techniques and applications of operations research. Includes linear programming, queueing theory, decision analysis, network analysis, and simulation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 425 Mathematical Analysis
Prerequisites: MATH 325 or permission
Description: Real number system, topology of Euclidean space and metric spaces, compactness, sequences, series, convergence and uniform convergence, and continuity and uniform continuity.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 427 Mathematical Methods in the Physical Sciences
Crosslisted with: MATH 827
Prerequisites: MATH 221.
Description: Matrix operations, transformations, inverses, orthogonal matrices, rotations in space. Eigenvalues and eigenvectors, diagonalization, applications of diagonalization. Curvilinear coordinate systems, differential operations in curvilinear coordinate systems, Jacobians, changes of variables in multiple integration. Scalar, vector and tensor fields, tensor operations, applications or tensors. Complex function theory, integration by residues, conformal mappings.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 428 Principles of Operations Research
Crosslisted with: MATH 828
Prerequisites: MATH 314 and either STAT 380 or MECH 321.
Description: Introduction to techniques and applications of operations research. Includes linear programming, queueing theory, decision analysis, network analysis, and simulation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses

MATH 429 Mathematical Models in Biology
Crosslisted with: MATH 839
Prerequisites: MATH 107 or permission
Notes: MATH 439/839 has a small laboratory component.
Description: Discrete and continuous models in ecology: population models, predation, food webs, the spread of infectious diseases, and life histories. Elementary biochemical reaction kinetics; random processes in nature. Use of software for computation and graphics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses

MATH 430 Ordinary Differential Equations
Prerequisites: MATH 221 or 221H, and either 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
Format: LEC
Groups: Advanced Mathematics Courses

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

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

MATH 435 Math in the City
Prerequisites: Math 208 and at least two of Math 221, Math 314, Math 380
Description: A research experience modeling problems of current interest to the local community, businesses, or government.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product

MATH 439 Mathematical Models in Biology
Crosslisted with: MATH 839
Prerequisites: MATH 107 or permission
Notes: MATH 439/839 has a small laboratory component.
Description: Discrete and continuous models in ecology: population models, predation, food webs, the spread of infectious diseases, and life histories. Elementary biochemical reaction kinetics; random processes in nature. Use of software for computation and graphics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses
MATH 440 Numerical Analysis I
Crosslisted with: CSCE 440, CSCE 840, MATH 840
Prerequisites: CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, CSCE 155T, or SOFT 160; Math 107.
Notes: Credit toward the degree may be earned in only one of the following: CSCE/MATH 440/840 and MECH 480/880.
Description: Principles of numerical computing and error analysis covering numerical error, root finding, systems of equations, interpolation, numerical differentiation and integration, and differential equations. Modeling real-world engineering problems on digital computers. Effects of floating point arithmetic.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

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

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

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

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

MATH 450 Combinatorics
Prerequisites: MATH 310 or MATH 325
Notes: Selected applications.
Description: Theory of directed and undirected graphs. Trees, circuits, subgraphs, matrix representations, coloring problems, and planar graphs. Methods which can be implemented by computer algorithms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

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

MATH 456 Differential Geometry I
Prerequisites: MATH 221 or 221H; MATH 314 or 314H; and MATH 322.
Description: Introduction to a selection of topics in modern differential manifolds, vector bundles, vector fields, tensors, differential forms, Stoke's theorem, Riemannian and semi-Riemannian metrics, Lie Groups, connections, singularities. Includes gauge field theory, catastrophe theory, general relativity, fluid flow.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 465 Introduction to Mathematical Logic
Crosslisted with: MATH 865
Description: Semantical and syntactical developments of propositional logic, discussion of several propositional calculi, application of Boolean algebra and related topics, semantics and syntax of first order predicate logic including Godel's completeness theorem, the compactness theorem.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses
MATH 471 Introduction to Topology  
**Prerequisites:** Math 314 and either Math 325 or 310  
**Description:** Elementary point-set and geometric topology. Point-set topics include topological spaces, continuous functions, homeomorphisms, connectedness, compactness, quotient spaces. Geometric topology topics include Euler characteristic, classification of surfaces, and other applications.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** MATH 856

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

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

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

MATH 497 Reading Course  
**Prerequisites:** Senior standing and especially qualified Juniors; and permission.  
**Credit Hours:** 1-4  
**Min credits per semester:** 1  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** IND  
**Groups:** Seminars, Ind Study, Topics

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

Mathematics (B.A.)

16 HR TERM 1  
**Calculus Sequence**  
complete MATH 106  
**Credit:** 5hr  
**Grade:** C  
**Note:** MATH 106 will fulfill the ACE 3 requirement.

**ACE 1 Written Texts**  
complete 1 from ACE1  
**Credit:** 3hr

**ACE 6 Social Sciences**  
complete 1 from ACE6  
**Credit:** 3hr

**CDR E: Language**  
recommend 1 or more courses  
**Credit:** 5hr  
If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

15 HR TERM 2  
**Calculus Sequence**  
complete MATH 107  
**Credit:** 4hr
**CDR A: Writing**

Complete an additional course approved as ACE 1.

**CDR E: Language**

recommend 1 or more courses

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

**Electives**

complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

**14 HR TERM 3**

**Calculus Sequence**

complete MATH 208

MATH 208 becomes critical to your success in the major if not completed by the third term of enrollment.

**ACE 2 Communication Skill**

complete 1 from ACE2

**CDR B: Math/Sci w/Lab**

complete 1 from Approved Science Courses

Complete an approved course from a Math or Science discipline with a lab: ASTR, BIOC, BIOS, CHEM, CSCE, GEOL, LIFE, MATH, METR, PHYS, STAT (select ANTH or GEOG allowed).

**CDR B: Lab**

complete 1 from ASCLAB1

**15 HR TERM 4**

**Mathematics Core**

complete MATH 314

**ACE 4 Sciences**

complete 1 from ACE4

**CDR E: Language**

recommend 1 or more courses

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

**Electives**

complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

**15 HR TERM 5**

**Mathematics Core**

complete MATH 310

Mathematics Core

complete either MATH 221 or MATH 380
ACE 5 Humanities
complete 1 from ACE5

ACE 8 Ethical Principles
complete 1 from ACE8

Electives
complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

12 HR TERM 6

Mathematics Core
complete MATH 325

MATH 325 becomes critical to your success in the major if not completed by the sixth term of enrollment.

ACE 7 Arts
complete 1 from ACE7

CDR C: Humanities
complete 1 from Any Arabic Course at the 300 Level, Any Classics Course, Any Czech Course at the 300 Level, Any Czech Course at the 400 Level, Any English Course, FREN 282, Any French Course at the 300 Level, Any French Course at the 400 Level, GERM 282, Any German Course at the 300 Level, Any German Course at the 400 Level, Any Greek Course at the 300 Level, Any Greek Course at the 400 Level, Any Hebrew Course at the 300 Level, Any History Course, Any Japanese Course at the 300 Level, Any Latin Course at the 300 Level, Any Latin Course at the 400 Level, Any Philosophy Course, Any Religious Studies Course at any Level, Any Russian Course at the 300 Level, Any Russian Course at the 400 Level, SPAN 264, SPAN 265, Any Spanish Course at the 300 Level, Any Spanish Course at the 400 Level

Complete an approved course from a Humanities discipline: ARAB, CLAS, C2EC, ENGL, FILM, FREN, GERM, GREK, HEBR, HIST, JAPN, LATN, PHIL, RELG, RUSS, SPAN.

Electives
complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

12 HR TERM 7

Advanced Math
complete either Any Math Course at the 300 Level or Any Math Course at the 400 Level

Complete a 400 level MATH to fulfill your ACE 10 requirement and one additional 400 level MATH course.

CDR D: Social Sciences
complete 1 from Any Anthropology Course, Any Communications Course, Any Geography Course, Any National Securities Studies Course, Any Political Science Course, Any Psychology Course, Any Sociology Course

Complete an approved course from a Social Science discipline: ANTH, COMM, GEOG, NSST, POLS, PSYC, SOCI.

ACE 9 Global/Human Divers
complete 1 from ACE9

Electives
complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

18 HR TERM 8

Advanced Math
complete Any Math Course at the 400 Level

Complete a 400 level MATH to fulfill your ACE 10 requirement and one additional 400 level MATH course.
CDR F: Additional Breadth
recommend 1 or more courses

Complete an approved additional courses from CDR B, CDR C, or CDR D that is outside of the discipline of your primary major.

Electives
complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

Graduation Requirements
1. A minimum 2.00 GPA required for graduation.
2. ***Total Credits Applying Toward 120 Total Hours***
3. Complete 30 hours in residence at UNL.

Mathematics (B.S.)

16 HR TERM 1
Calculus Sequence
complete MATH 106

MATH 106 will fulfill the ACE 3 requirement.

ACE 1 Written Texts
complete 1 from ACE1

ACE 6 Social Sciences
complete 1 from ACE6

CDR E: Language
recommend 1 or more courses

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

14 HR TERM 3
Calculus Sequence
complete MATH 208

MATH 208 becomes critical to your success in the major if not completed by the third term of enrollment.

CDR B: Math/Sci w/Lab
complete 1 from Approved Science Courses

Complete an approved course from a Math or Science discipline with a lab: ASTR, BIOC, BIOS, CHEM, CSCE, GEOL, LIFE, MATH, METR, PHYS, STAT (select ANTH or GEOG allowed).

CDR B: Lab
complete 1 from ASCLAB1

Complete an approved lab associated with a course from a Math or Science discipline: BIOS, CHEM, GEOL, LIFE, METR, PHYS (select ANTH or GEOG allowed).

CDR E: Language

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

15 HR TERM 2
Calculus Sequence
recommend 1 or more courses

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

Electives
complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

15 HR TERM 4

Mathematics Core
complete MATH 314

ACE 2 Communication Skill
complete 1 from ACE2

ACE 7 Arts
complete 1 from ACE7

CDR E: Language
recommend 1 or more courses

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

Electives
complete Any Course

18 HR TERM 6

Mathematics Core
complete MATH 325

Math Option Course
complete either Any Math Course at the 300 Level or Any Math Course at the 400 Level
Complete an approved advanced MATH course.

ACE 9 Global/Human Divers
complete 1 from ACE9
3hr

CDR C: Humanities
complete 1 from Any Arabic Course at the 300 Level, Any Classics Course, Any Czech Course at the 300 Level, Any Czech Course at the 400 Level, Any English Course, FREN 282, Any French Course at the 400 Level, Any French Course at the 400 Level, GERM 282, Any German Course at the 300 Level, Any German Course at the 400 Level, Any Greek Course at the 300 Level, Any Greek Course at the 400 Level, Any Hebrew Course at the 300 Level, Any History Course, Any Japanese Course at the 300 Level, Any Latin Course at the 300 Level, Any Latin Course at the 400 Level, Any Philosophy Course, Any Religious Studies Course at any Level, Any Russian Course at the 300 Level, Any Russian Course at the 400 Level, SPAN 264, SPAN 265, Any Spanish Course at the 300 Level, Any Spanish Course at the 400 Level
3hr

Complete an approved course from a Humanities discipline: ARAB, CLAS, CZEC, ENGL, FILM, FREN, GERM, GREK, HEBR, HIST, JAPN, LATN, PHIL, RELG, RUSS, SPAN.

Electives
complete Any Course
6hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

15 HR TERM 7

Math Option Course
complete Any Math Course at the 400 Level
6hr

Complete 2 approved advanced MATH courses at the 400 level.

ACE 8 Ethical Principles
complete 1 from ACE8
3hr

Electives
complete Any Course
6hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

15 HR TERM 8

Math Option Course
complete Any Math Course at the 400 Level
3hr

Complete a 400 level MATH to fulfill your ACE 10 requirement.

CDR F: Additional Breadth
recommend 1 or more courses
3hr

Complete an approved additional courses from CDR B, CDR C, or CDR D that is outside of the discipline of your primary major.

Electives
complete Any Course
9hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

Graduation Requirements
1. A minimum 2.00 GPA required for graduation.
2. ***Total Credits Applying Toward 120 Total Hours***
3. Complete 30 hours in residence at UNL.

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
• Comprehend and critically evaluate complex information
• Use quantitative & analytical computational techniques
• Make predictions using mathematical, statistical, and scientific modeling methods
• Understand and use proper laboratory and technical skills and instruments
• Define problems and identifying causes
• Support and communicate claims using clear evidence
• Simplify complex information and present it to others
• Apply mathematical and scientific skills to solve real-world problems
• Document and replicate processes and procedures
• Design and implement research experiments

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

Internships
• Data Science Intern, The Hartford Insurance Company - Hartford CT
• Actuarial Intern, Lincoln Financial Group - Omaha NE
• Intern, American Embassy - Berlin, Germany ZZ
• 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 -
• Intern - Group Actuarial, Ameritas Life Insurance Corp. - Lincoln NE

Grad Schools
• Mathematics Ph.D, University of Nebraska-Lincoln - Lincoln NE
• Physics Ph.D. Program, University of Nebraska-Lincoln - Lincoln NE
• Economics PhD, University of Tennessee - Knoxville TN
• Masters of Computer Science, University of Malaya - Kuala Lumpur ZZ
• Ph.D. Program for Neural Computation, Center for Neural Basis of Cognition - Pittsburgh PA
• Doctorate of Physcial Therapy, Creighton University - Omaha NE
• PhD in Statistics, University of Nebraska-Lincoln - Lincoln NE
• Masters in System Engineering, University of Pennsylvania - Philadelphia PA
• Biostatistics Graduate Program, University of Southern California - Los Angeles CA
• Agricultural & Resource Economics, Ph.D., University of California, Berkley - Berkley CA