

Department of Mathematics

(College of Humanities, Arts and Sciences)

www.uni.edu/math

The Department of Mathematics offers the following undergraduate and graduate programs. Specific requirements for these programs are listed within this Department of Mathematics section in the following order:

Undergraduate Majors (B.A.)

- Mathematics (p. 1)
- Mathematics-Statistics/Actuarial Science (p. 2)
- Mathematics-Teaching (p. 3)

Minors

- Data Science (p. 4) (also listed in Department of Computer Science and Department of Physics)
- Mathematics (p. 4)
- Mathematics-Teaching (p. 5)
- Mathematics (K-8)-Teaching (p. 5)
- Statistics and Actuarial Science (p. 5)

Graduate Majors (M.A.)

- Mathematics (p. 6):
 - Mathematics
 - Secondary Teaching
 - Community College Teaching
- Mathematics for the Elementary and Middle Grades (K-8) (p. 7)

Graduate Majors (P.S.M.)

- Industrial Mathematics (p. 8)

Program Certificate

- Statistical Computing (p. 9)

Notes:

1. A student majoring or minoring in mathematics, who has a grade point average of less than 2.25 in all departmental courses used for that major or minor may not apply a departmental course in which a grade of less than C- is earned to her/his major or minor.
2. Undergraduate students who have been admitted to the university provisionally because of non-satisfaction of the high school mathematics requirements may not enroll in any mathematics credit course before this requirement has been met.
3. Students who complete the requirements for more than one program (major or minor) within mathematics may have that noted on their transcripts.

Bachelor of Arts Degree Programs Mathematics Major

The Mathematics major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours. Students are encouraged to discuss Undergraduate Research (MATH 4990) with their adviser.

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|---|--|-----|
| Common core: | | 15 |
| MATH 1420 (800:060) | Calculus I * | |
| MATH 1421 (800:061) | Calculus II | |
| MATH 2422 (800:062) | Calculus III | |
| MATH 2500 (800:076) | Linear Algebra for Applications | |
| Mathematics core: | | 16 |
| MATH 2900 | Discrete and Argumentative Mathematics | |
| MATH 4420/5420 (800:140g) | Advanced Calculus I | |
| MATH 4421/5421 (800:141g) | Advanced Calculus II | |
| MATH 4500/5500 (800:160g) | Modern Algebra I | |
| MATH 4501/5501 (800:162g) | Modern Algebra II | |
| MATH 4900 (800:194) | Senior Mathematics Seminar | |
| Probability/Statistics: select one of the following. | | 3-6 |
| MATH/STAT 3751 will not satisfy this requirement if a student has credit for STAT 1772 (800:072). | | |
| MATH/STAT 3751 | Probability and Statistics | |
| STAT 1772 (800:072) | Introduction to Statistical Methods | |
| and | | |
| MATH/STAT 3752 | Introduction to Probability | |
| STAT 1772 (800:072) | Introduction to Statistical Methods | |
| & STAT 3771/5771 (800:121g) | and Applied Statistical Methods for Research | |
| Electives: Select two of the following. | | 6 |
| STAT 3752/5752 (800:152g) cannot be used if used for the Probability/Statistics requirement. Other junior/senior level mathematics courses may be substituted with approval of advisor and Department Head. | | |
| MATH 3410/5410 (800:142g) | Dynamical Systems: Chaos Theory and Fractals | |
| MATH 3425/5425 (800:149g) | Differential Equations | |

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|------------------------------|-------------------------------------|
| MATH 3440/5440 (800:176g) | Numerical Analysis * |
| MATH 3530/5530 (800:143g) | Combinatorics |
| MATH 3600/5600 (800:166g) | Euclidean Geometry |
| MATH 3610/5610 (800:165g) | Modern Geometries |
| MATH 3630/5630 (800:155g) | Differential Geometry |
| MATH 3640/5640 (800:180g) | History of Mathematics |
| MATH/STAT 3752 | Introduction to Probability |
| MATH/ACT SCI 3780 | Mathematics of Finance |
| MATH 4460/5460 (800:156g) | Introduction to Complex Analysis |
| MATH 4510/5510 (800:144g) | Elementary Number Theory |
| MATH 4641/5641 (800:167g) | Topology I |

Total Hours **40-43**

* These courses have additional prerequisites as follows:
 MATH 1420 (800:060) has prerequisite of a satisfactory score on a mathematics placement exam, or subsequent remediation.
 MATH 3440/5440 (800:176g) has prerequisite of CS 1130 (810:030), CS 1160 (810:036), or CS 1510 (810:051).

Mathematics Major-Statistics/Actuarial Science

The Mathematics-Statistics/Actuarial Science major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The major is available in two emphases, the Statistics emphasis and the Actuarial Science emphasis. Each emphasis requires completion of the common core, the seminar/research requirement, the core for the chosen emphasis (Statistics or Actuarial Science), and 6 hours of electives that do not duplicate course work chosen to meet the chosen emphasis (Statistics or Actuarial Science) core requirement.

Required

| | | |
|------------------------------------|--|----|
| Mathematics: | | |
| Common core: | | 15 |
| MATH 1420 (800:060) | Calculus I * | |
| MATH 1421 (800:061) | Calculus II | |
| MATH 2422 (800:062) | Calculus III | |
| MATH 2500 (800:076) | Linear Algebra for Applications | |
| Statistics/Actuarial Science core: | | 9 |
| STAT 1772 (800:072) | Introduction to Statistical Methods | |

| | | |
|--|--|----------|
| or STAT 1774 (800:064) | Introductory Statistics for Life Sciences | |
| STAT 3775/5775 (800:174g) | Introduction to Mathematical Statistics | |
| MATH/STAT 3752 | Introduction to Probability | |
| Computer Programming: | | 3-4 |
| Select one of the following: | | |
| CS 1130 (810:030) | Visual BASIC Programming | |
| CS 1160 (810:036) | C/C++ Programming | |
| CS 1510 (810:051) | Introduction to Computing | |
| STAT 4772/5772 (800:122g) | Statistical Computing I | |
| Seminar/research: | | 1-3 |
| MATH 4900 (800:194) | Senior Mathematics Seminar | |
| or MATH 4990 (800:195) | Undergraduate Research in Mathematics | |
| Select and complete ONE of the following Emphasis Core: | | 9 |
| Statistics Emphasis Core: | | |
| Select three from the following: | | |
| STAT 3771/5771 (800:121g) | Applied Statistical Methods for Research | |
| STAT 3776/5776 (800:175g) | Regression Analysis | |
| STAT 4773/5773 (800:123g) | Design and Analysis of Experiments | |
| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis | |
| Actuarial Science Emphasis Core: | | |
| Select three from the following: | | |
| ACT SCI/MATH 3780 | Mathematics of Finance | |
| ACT SCI 4735/5735 (800:153g) | Actuarial Mathematics | |
| ACT SCI 4739/5739 (800:158g) | Topics in Actuarial Science, Topics in Actuarial Science: Long-Term Actuarial Mathematics | |
| ACT SCI 4788/5788 (800:170g) | Loss Models | |
| ACT SCI 4785/5785 (800:197g) | Introduction to Financial Engineering | |
| Electives | | 6 |
| Select two electives from the following list. The same course cannot be used to satisfy both the emphasis core and elective requirement. | | |
| STAT 3771/5771 (800:121g) | Applied Statistical Methods for Research | |
| STAT 3776/5776 (800:175g) | Regression Analysis | |
| STAT 3778/5778 (800:171g) | Spatial Data Analysis | |
| STAT 4772/5772 (800:122g) | Statistical Computing I | |

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|---------------------------------|---|--------------|
| STAT 4773/5773 (800:123g) | Design and Analysis of Experiments | |
| STAT 4777/5777 (800:157g) | Statistical Quality Assurance Methods | |
| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis | |
| STAT 4782/5782 | Statistical Computing II | |
| ACT SCI 3731 (800:146) | Actuarial Examination Preparation ** | |
| ACT SCI 4735/5735 (800:153g) | Actuarial Mathematics | |
| ACT SCI 4739/5739 (800:158g) | Topics in Actuarial Science, Topics in Actuarial Science: Long-Term Actuarial Mathematics | |
| ACT SCI 4785/5785 (800:197g) | Introduction to Financial Engineering | |
| ACT SCI 4788/5788 (800:170g) | Loss Models | |
| MATH 3440/5440 (800:176g) | Numerical Analysis | |
| MATH 3780/5780 (800:145g) | Mathematics of Finance | |
| Total Hours | | 43-46 |

* MATH 1420 (800:060) has prerequisite of satisfactory score on mathematics placement exam or subsequent remediation.

** ACT SCI 3731 (800:146) may be repeated for credit for preparation for different exams, however only 3 hours will count toward the Statistics/Actuarial Science major.

Mathematics Major-Teaching

The Mathematics-Teaching major requires a minimum of 122-123 total hours to graduate.

This total includes Liberal Arts Core requirements, the Professional Education Requirements, and the following specified major requirements to complete the minimum of 122-123 hours.

Required

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|---------------------|--|---|
| Mathematics: | | |
| Common core: | | |
| MATH 1420 (800:060) | Calculus I * | 4 |
| MATH 1421 (800:061) | Calculus II | 4 |
| MATH 2422 (800:062) | Calculus III | 4 |
| MATH 2500 (800:076) | Linear Algebra for Applications | 3 |
| Teaching core: | | |
| MATH 1310 (800:096) | Technology for Secondary Mathematics Teachers | 3 |
| MATH 2303 | Introduction to Teaching Secondary Mathematics | 3 |
| MATH 2900 | Discrete and Argumentative Mathematics | 3 |
| MATH 3302 | Field Experience in Teaching Secondary Mathematics | 1 |

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|---|--|--------------|
| MATH 3304 (800:190) | The Teaching of Secondary Mathematics | 3 |
| MATH 3305 (800:183) | Connections: University Mathematics and the Secondary Curriculum | 3 |
| MATH 3313 | Topics in Secondary Mathematics | 3 |
| MATH 3600/5600 (800:166g) | Euclidean Geometry | 3 |
| MATH 4500/5500 (800:160g) | Modern Algebra I | 3 |
| Probability and Statistics: | | 3-6 |
| Select one of the following. MATH 3751 (800:173) / STAT 3751 will not satisfy this requirement if a student has credit for STAT 1772 (800:072). | | |
| MATH/STAT 3751 | Probability and Statistics | |
| STAT 1772 (800:072) | Introduction to Statistical Methods | |
| & MATH 3752/5752 and Introduction to Probability (800:152g) | | |
| STAT 1772 (800:072) | Introduction to Statistical Methods | |
| & STAT 3771/5771 and Applied Statistical Methods for Research (800:121g) | | |
| Select two of the following: | | 6 |
| MATH 3530/5530 (800:143g) | Combinatorics | |
| MATH 3610/5610 (800:165g) | Modern Geometries | |
| MATH 4420/5420 (800:140g) | Advanced Calculus I | |
| MATH 4501/5501 (800:162g) | Modern Algebra II | |
| MATH 4510/5510 (800:144g) | Elementary Number Theory | |
| MATH 4615/5615 (800:189g) | Geometric Transformations | |
| Computer Science: | | 3-4 |
| Select one of the following: | | |
| CS 1120 (810:056) | Media Computation | |
| CS 1130 (810:030) | Visual BASIC Programming | |
| CS 1160 (810:036) | C/C++ Programming | |
| CS ED 1320 | Fundamentals of Programming | |
| CS 1510 (810:051) | Introduction to Computing | |
| Total Hours | | 52-56 |

* MATH 1420 (800:060) has a prerequisite of satisfactory score on mathematics placement exam or subsequent remediation.

Notes: For departmental approval to student teach, a student in the program must satisfy the University requirements to student teach and the following specific departmental requirements:

- 1) Must earn a C- or better in: MATH 1420 (800:060), MATH 1421 (800:061), MATH 2500 (800:076), MATH 2900, MATH 3302, MATH 3600/5600 (800:166g), MATH 4500/5500 (800:160g), and courses taken to satisfy the Probability and Statistics and Computer

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Science requirements. MATH 3302 is offered credit/no credit only effective Fall 2019 and beyond, and student must pass this course.

2) Must earn a grade of C or higher in: MATH 2303 and MATH 3304 (800:190).

3) Must complete all of the courses in the major with a major grade point average of 2.50 or higher.

Minors

Data Science Minor

The Data Science minor is an interdisciplinary program that integrates computer programming, machine learning, statistics, predictive modeling and visualization to provide students with broad based skills for extracting gainful information from data that originate from a variety of sources. A final project (ideally with corporate or non-profit partnerships) will ensure that students employ their skills to solve a real-world problem.

Statistics:

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|---------------------|-------------------------------------|---|
| STAT 1772 (800:072) | Introduction to Statistical Methods | 3 |
| STAT 4784/5784 | Introduction to Machine Learning | 3 |

Computer Science:

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|-------------------|----------------------------|-----|
| CS 1510 (810:051) | Introduction to Computing | 4 |
| CS 2150 | Computing for Data Science | 3-6 |

or

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| CS 1520 (810:052) & CS 1800 (810:080) | Data Structures and Discrete Structures | |
| CS 3140/5140 (810:114g) | Database Systems | 3 |

Physics:

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|-------------------|---|---|
| PHYSICS 4160/5160 | Data Visualization, Modeling and Simulation | 3 |
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| Required Data Science Project | | 2-3 |
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| CS 4800 (810:180) | Undergraduate Research in Computer Science | |
| or MATH 4990 (800:195) | Undergraduate Research in Mathematics | |
| or PHYSICS 3000 (880:180) | Undergraduate Research in Physics | |

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| Total Hours | | 21-25 |
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Mathematics Minor

Required

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|---------------------|---------------------------------|----|
| Mathematics: | | 11 |
| MATH 1420 (800:060) | Calculus I * | |
| MATH 1421 (800:061) | Calculus II | |
| MATH 2500 (800:076) | Linear Algebra for Applications | |

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| Electives | | 12 |
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Mathematics:

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| ACT SCI 4739/5739 (800:158g) | Topics in Actuarial Science, Topics in Actuarial Science: Long-Term Actuarial Mathematics |
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| MATH 2422 (800:062) | Calculus III |
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| MATH 2900 | Discrete and Argumentative Mathematics |
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| MATH 3410/5410 (800:142g) | Dynamical Systems: Chaos Theory and Fractals |
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| MATH 3425/5425 (800:149g) | Differential Equations |
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| MATH 3430/5430 (800:150g) | Partial Differential Equations |
|---------------------------|--------------------------------|

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|---------------------------|--------------------|
| MATH 3440/5440 (800:176g) | Numerical Analysis |
|---------------------------|--------------------|

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|---------------------------|---------------|
| MATH 3530/5530 (800:143g) | Combinatorics |
|---------------------------|---------------|

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|---------------------------|--------------------|
| MATH 3600/5600 (800:166g) | Euclidean Geometry |
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|---------------------------|-------------------|
| MATH 3610/5610 (800:165g) | Modern Geometries |
|---------------------------|-------------------|

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|---------------------------|-----------------------|
| MATH 3630/5630 (800:155g) | Differential Geometry |
|---------------------------|-----------------------|

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|---------------------------|------------------------|
| MATH 3640/5640 (800:180g) | History of Mathematics |
|---------------------------|------------------------|

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|---------------------|----------------------------|
| MATH 3751 (800:173) | Probability and Statistics |
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| MATH/STAT 3752 | Introduction to Probability |
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| MATH 4420/5420 (800:140g) | Advanced Calculus I |
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| MATH 4421/5421 (800:141g) | Advanced Calculus II |
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|---------------------------|----------------------------------|
| MATH 4460/5460 (800:156g) | Introduction to Complex Analysis |
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| MATH 4500/5500 (800:160g) | Modern Algebra I |
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|---------------------------|-------------------|
| MATH 4501/5501 (800:162g) | Modern Algebra II |
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|---------------------------|--------------------------|
| MATH 4510/5510 (800:144g) | Elementary Number Theory |
|---------------------------|--------------------------|

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|---------------------------|---------------------------|
| MATH 4615/5615 (800:189g) | Geometric Transformations |
|---------------------------|---------------------------|

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| MATH 4641/5641 (800:167g) | Topology I |
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| STAT 3775/5775 (800:174g) | Introduction to Mathematical Statistics |
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| STAT 3776/5776 (800:175g) | Regression Analysis |
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| STAT 4777/5777 (800:157g) | Statistical Quality Assurance Methods |
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| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis |
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|--------------------|--|-----------|
| Total Hours | | 23 |
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* MATH 1420 (800:060) has prerequisite of satisfactory score on mathematics placement exam or subsequent remediation.

Mathematics Minor-Teaching

Required

| | | |
|------------------------------|--|--------------|
| Mathematics: | | |
| MATH 1420 (800:060) | Calculus I * | 4 |
| MATH 1421 (800:061) | Calculus II | 4 |
| Select one of the following: | | 3 |
| STAT 1772 (800:072) | Introduction to Statistical Methods | |
| STAT 1774 (800:064) | Introductory Statistics for Life Sciences | |
| MATH 3751 (800:173) | Probability and Statistics | |
| MATH 2303 | Introduction to Teaching Secondary Mathematics | 3 |
| MATH 2500 (800:076) | Linear Algebra for Applications | 3 |
| MATH 2900 | Discrete and Argumentative Mathematics | 3 |
| MATH 3600/5600 (800:166g) | Euclidean Geometry | 3 |
| MATH 4500/5500 (800:160g) | Modern Algebra I | 3 |
| MATH 3302 | Field Experience in Teaching Secondary Mathematics | 1 |
| MATH 3304 (800:190) | The Teaching of Secondary Mathematics | 3 |
| Computer Science: | | |
| Select one of the following: | | 3-4 |
| CS 1120 (810:056) | Media Computation | |
| CS 1130 (810:030) | Visual BASIC Programming | |
| CS 1160 (810:036) | C/C++ Programming | |
| CS ED 1320 | Fundamentals of Programming | |
| CS 1510 (810:051) | Introduction to Computing | |
| Total Hours | | 33-34 |

* MATH 1420 (800:060) has prerequisite of satisfactory score on mathematics placement exam or subsequent remediation.

Notes: For departmental approval to student teach, a student in the program must satisfy the University requirements to student teach and the following specific departmental requirements:

1) Must earn a C- or better in MATH 1420, MATH 1421, MATH 2500, MATH 2900, MATH 3302, MATH 3600, MATH 4500, and STAT 1772 or STAT 1774 or MATH 3751. MATH 3302 is offered credit/no credit only effective Fall 2019 and beyond, and student must pass this course.

2) Must earn a grade of C or higher in MATH 2303 and MATH 3304.

3) Must complete all of the courses in the minor with a minor grade point average of 2.50 or higher

Mathematics Minor (K-8)-Teaching

Required

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| Mathematics: | | |
| MATH 1204 | Mathematical Reasoning for Elementary Teachers I | 3 |
| MATH 2204 | Mathematical Reasoning for Elementary Teachers II | 3 |
| MATH 3204 | Mathematical Reasoning for Elementary Teachers III | 3 |
| MATH 3211 (800:111g) | Introduction to Algebraic Thinking for Elementary Teachers | 3 |
| MATH 3212/5212 (800:112g) | Introduction to Geometry and Measurement for Elementary Teachers | 3 |
| MATH 3213/5213 (800:113g) | Topics in Mathematics for Grades K-8 | 3 |
| MATH 3214/5214 (800:114g) | Problem Solving in Mathematics for Elementary Teachers | 3 |
| Computer Science: | | |
| CS ED 1310 | Programming Environments for Elementary Education | 3 |
| Total Hours | | 24 |

Statistics and Actuarial Science Minor

Complete one of the following emphases

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|------------------------------------|--|-----------|
| Actuarial Science emphasis: | | 14 |
| MATH 1420 (800:060) | Calculus I * | 4 |
| MATH 1421 (800:061) | Calculus II | 4 |
| ACT SCI/MATH 3780 | Mathematics of Finance | 3 |
| MATH/STAT 3752 | Introduction to Probability | 3 |
| Statistics emphasis | | 12 |
| STAT 1772 (800:072) | Introduction to Statistical Methods | 3 |
| STAT 3771/5771 (800:121g) | Applied Statistical Methods for Research | 3 |
| STAT 4772/5772 (800:122g) | Statistical Computing I | 3 |
| STAT 4782/5782 | Statistical Computing II | 3 |
| Electives | | 9 |

Select three courses from the following or from the emphasis not chosen:

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|------------------------------|---------------------------------------|---|
| ACT SCI 3731 (800:146) | Actuarial Examination Preparation | 3 |
| ACT SCI 4785/5785 (800:197g) | Introduction to Financial Engineering | 3 |
| ACT SCI 4735/5735 (800:153g) | Actuarial Mathematics | 3 |
| ACT SCI 4788/5788 (800:170g) | Loss Models | 3 |
| MATH 2422 (800:062) | Calculus III | 4 |
| MATH 2500 (800:076) | Linear Algebra for Applications | 3 |

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|------------------------------|---|--------------|
| STAT 3775/5775 (800:174g) | Introduction to Mathematical Statistics | 3 |
| STAT 3776/5776 (800:175g) | Regression Analysis | 3 |
| STAT 3778/5778 (800:171g) | Spatial Data Analysis | 3 |
| STAT 4773/5773 (800:123g) | Design and Analysis of Experiments | 3 |
| STAT 4777/5777 (800:157g) | Statistical Quality Assurance Methods | 3 |
| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis | 3 |
| Total hours | | 21-24 |

* MATH 1420 (800:060) has a prerequisite of satisfactory score on mathematics placement exam or subsequent remediation.

Master of Arts Degree Programs

Major in Mathematics

The major in Mathematics is available in three emphases: Mathematics, Secondary Teaching, and Community College Teaching.

Only graduate courses (course numbers 5000 or above) will apply to a graduate degree, even if the undergraduate course number (4999 or less) is listed. No exceptions will be made.

The Mathematics emphasis is available on the **thesis** and **non-thesis** options. A **minimum of 36 hours** is required for the **thesis** option, including 6 hours of MATH 6299 (800:299) and a **minimum of 15 additional hours of 200/6000-level course work**. A **minimum of 33 hours** is required for the **non-thesis** option, including a minimum of 3 hours of MATH 6299 (800:299) and a **minimum of 15 additional hours of 200/6000-level course work**.

The Secondary Teaching emphasis is offered on a **non-thesis** option only; a **minimum of 30 hours**, including a **minimum of 18 hours of 200/6000-level course work** is required.

The Community College Teaching emphasis is offered on a **non-thesis** option only; a **minimum of 30 hours**, including a **minimum of 15 hours of 200/6000-level course work** is required.

Students interested in this program must submit a completed Application for Admission to Graduate Study and should refer to their MyUNIverse Student Center To-Do list or contact the Department of Mathematics for other application requirements. Graduate information and application for graduate admission can be found at www.grad.uni.edu/admission.

The Graduate Record Examination (General Test) **is not** required for admission to the program.

Courses taken to satisfy B.A. requirements may not be repeated to count toward the graduate program.

Successful completion of a final written comprehensive examination is required for the **non-thesis option on the Mathematics emphasis only**.

Mathematics Emphasis

Required

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|---------------------------------------|---|---|
| Mathematics: | | |
| MATH 3630/5630 (800:155g) | Differential Geometry | 3 |
| | or MATH 4615/5615 Geometric Transformations (800:189g) | |
| MATH 6420 (800:201) | Mathematical Analysis I | 3 |
| MATH 6460 (800:203) | Complex Analysis I | 3 |
| MATH 6500 (800:240) | Abstract Algebra I | 3 |
| Select at least two of the following: | | 6 |

| | | |
|-----------------------------|--------------------------|--------|
| MATH 6421 (800:202) | Mathematical Analysis II | |
| MATH 6461 (800:204) | Complex Analysis II | |
| MATH 6501 (800:241) | Abstract Algebra II | |
| Research: | | 3 or 6 |
| MATH 6299 (800:299) | Research | |
| Thesis option (6 hours) | | |
| Non-thesis option (3 hours) | | |

Electives **12**

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|---|---|--|
| Mathematics: | | |
| Select 12 hours from any of the courses listed above that were not used for the requirements there or from among the following: | | |
| ACT SCI 4739/5739 (800:158g) | Topics in Actuarial Science, Topics in Actuarial Science: Long-Term Actuarial Mathematics | |
| MATH 3425/5425 (800:149g) | Differential Equations | |
| MATH 3430/5430 (800:150g) | Partial Differential Equations | |
| MATH 3440/5440 (800:176g) | Numerical Analysis | |
| MATH 3530/5530 (800:143g) | Combinatorics | |
| MATH 3640/5640 (800:180g) | History of Mathematics | |
| MATH/STAT 3752 | Introduction to Probability | |
| MATH 4421/5421 (800:141g) | Advanced Calculus II | |
| MATH 4460/5460 (800:156g) | Introduction to Complex Analysis | |
| MATH 4501/5501 (800:162g) | Modern Algebra II | |
| MATH 4641/5641 (800:167g) | Topology I | |
| MATH 6510 (800:210) | Theory of Numbers | |
| MATH 6640 (800:246) | Topics in the History of Mathematics | |

| | | |
|-------------------------------|---|----|
| MATH 6650 (800:263) | Topics in Mathematical Logic and Set Theory | |
| MATH 6779 (800:273) | Topics in Probability and Statistics | |
| STAT 3775/5775 (800:174g) | Introduction to Mathematical Statistics | |
| STAT 3776/5776 (800:175g) | Regression Analysis | |
| STAT 4777/5777 (800:157g) | Statistical Quality Assurance Methods | |
| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis | |
| Total hours thesis option | | 36 |
| Total hours non-thesis option | | 33 |

Secondary Teaching Emphasis

The Secondary Teaching emphasis is designed for secondary school mathematics teachers interested in developing a deeper background in mathematics and pedagogy to enhance teaching and increase student learning.

Required

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|---------------------------------------|---|-----------|
| Mathematics Education: | | |
| MATH 6201 (800:220) | Foundations of Mathematics Education | 3 |
| MATH 6381 (800:281) | Current Research in Mathematics Education | 3 |
| MATH 6209 | Mathematics Curriculum and Assessment | 3 |
| MATH 6225 | Teaching and Learning Mathematics | 3 |
| MATH 6236 | Equity and Mathematics Education | 3 |
| Mathematics: | | |
| MATH 6371 (800:271) | Probability and Statistical Inference | 3 |
| MATH 6370 (800:270) | Applied Linear Statistical Methods | 3 |
| Select one course from the following: | | |
| MATH 6212 (800:211) | Foundations of Algebraic Reasoning | 3 |
| or MATH 6504 | Advanced Linear Algebra | |
| Select One Course from the Following: | | |
| MATH 6215 | Foundations of Geometric Reasoning | 3 |
| or MATH 6670 (800:267) | Non-Euclidean Geometry | |
| Select One Course from the Following: | | |
| MATH 6410 | Foundations of Calculus | 3 |
| or MATH 6205 (800:215) | Teaching Rational Numbers and Proportionality | |
| Total Hours | | 30 |

Community College Teaching Emphasis

The Community College Teaching emphasis is designed to serve those seeking to prepare for a career in community college teaching

or working professionals in the field who are seeking career advancement.

Required:

| | | |
|------------------------|---|-----------|
| Mathematics Education: | | |
| MATH 6201 (800:220) | Foundations of Mathematics Education | 3 |
| MATH 6381 (800:281) | Current Research in Mathematics Education | 3 |
| MATH 6225 | Teaching and Learning Mathematics | 3 |
| MATH 6236 | Equity and Mathematics Education | 3 |
| MATH 6209 | Mathematics Curriculum and Assessment | 3 |
| Mathematics: | | |
| MATH 6504 | Advanced Linear Algebra | 3 |
| MATH 6370 (800:270) | Applied Linear Statistical Methods | 3 |
| MATH 6371 (800:271) | Probability and Statistical Inference | 3 |
| MATH 6410 | Foundations of Calculus | 3 |
| MATH 6670 (800:267) | Non-Euclidean Geometry | 3 |
| Total Hours | | 30 |

Major in Mathematics for the Elementary and Middle Grades (K-8)

This major is intended for teachers interested in mathematics for the elementary and middle grades (K-8) and for mathematics specialists and supervisors. Teacher licensure is a prerequisite for completing the program approval process for this major. Normally, candidates will have at least 2 years teaching experience.

Students interested in this program must submit a completed Application for Admission to Graduate Study and should refer to their MyUNiverse Student Center To-Do list or contact the Department of Mathematics for other application requirements. Graduate information and application for graduate admission can be found at www.grad.uni.edu/admission.

The Graduate Record Examination (General Test) **is not** required for admission to the program.

Only graduate courses (course numbers 5000 or above) will apply to a graduate degree, even if the undergraduate course number (4999 or less) is listed. No exceptions will be made.

This major is available on the **non-thesis** option only; a **minimum of 30 hours** is required. A **minimum of 15 hours of 200/6000-level course work is required.**

Required

| | | |
|------------------------|---|---|
| Mathematics Education: | | |
| MATH 6201 (800:220) | Foundations of Mathematics Education | 3 |
| MATH 6205 (800:215) | Teaching Rational Numbers and Proportionality | 3 |
| MATH 6212 (800:211) | Foundations of Algebraic Reasoning | 3 |

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| | | |
|---------------------|---|-----------|
| MATH 6215 | Foundations of Geometric Reasoning | 3 |
| MATH 6381 (800:281) | Current Research in Mathematics Education | 3 |
| MATH 6227 | Data Analysis, Probability, and Discrete Mathematical Reasoning | 3 |
| MATH 6225 | Teaching and Learning Mathematics | 3 |
| MATH 6236 | Equity and Mathematics Education | 3 |
| MATH 6216 | Number and Operations | 3 |
| MATH 6209 | Mathematics Curriculum and Assessment | 3 |
| Total Hours | | 30 |

Professional Science Master's Degree Program

Major in Industrial Mathematics

The Professional Science Master's Degree in Industrial Mathematics is designed to prepare students for a career in industry. The curriculum combines a business and experiential component with advanced course work.

Students interested in this program must submit a completed Application for Admission to Graduate Study and should refer to their MyUNiverse Student Center To-Do list or contact the Department of Mathematics for any other application requirements. Graduate information and application for graduate admission can be found at www.grad.uni.edu/admission.

The Graduate Record Examination (General Test) **is not** required for admission to the program.

Only graduate courses (course numbers 5000 or above) will apply to a graduate degree, even if the undergraduate course number (4999 or less) is listed. No exceptions will be made.

This major is a **non-thesis** program. A **minimum of 30 hours** is required. A **minimum of 12 hours of 6000-level course work is required.**

No comprehensive examination is required for this **non-thesis** option.

Requirements for admission to the program include the completion of a bachelor's degree with a GPA of 3.00 or higher and successful completion of the following university-level courses:

Prerequisite Courses:

| | | |
|---|-------------------------------------|---|
| MATH 1420 (800:060) | Calculus I | 4 |
| MATH 1421 (800:061) | Calculus II | 4 |
| MATH 2422 (800:062) | Calculus III | 4 |
| MATH 2500 (800:076) | Linear Algebra for Applications | 3 |
| STAT 1772 (800:072) | Introduction to Statistical Methods | 3 |
| One course in computer programming (or equivalent): | | |
| CS 1130 (810:030) | Visual BASIC Programming | 3 |

| | | |
|-------------------|---------------------------|---|
| CS 1160 (810:036) | C/C++ Programming | 3 |
| CS 1510 (810:051) | Introduction to Computing | 4 |

This major requires completion of 9 hours of the PSM Industrial Mathematics core, and 21 hours of electives.

Required Core:

| | | |
|---------------------|-----------------------------------|---|
| MATH 6745 (800:250) | Deterministic Operations Research | 3 |
| MATH 6747 (800:252) | Discrete-Event System Simulation | 3 |
| MATH 6796 | PSM Capstone Project | 3 |

Electives from the following: 21

| | | |
|---------------------------|----------------------|--|
| Marketing: | | |
| MKTG 4170/5170 (130:191g) | Marketing Strategy | |
| or MKTG 6170 (130:263) | Marketing Management | |

| | | |
|---------------------|--|--|
| Management: | | |
| MGMT 6250 (150:250) | Strategic Planning and Organization Analysis | |
| MGMT 6262 (150:272) | Cross-Functional Operations | |

| | | |
|--------------------------|----------------------------------|--|
| Finance: | | |
| FIN 3130/5130 (160:151g) | Corporate Finance | |
| FIN 3160/5160 (160:152g) | Principles of Investments | |
| FIN 6266 (160:266) | Financial Management and Markets | |

| | | |
|---------------------------|------------------------------|--|
| Technology: | | |
| TECH 3024/5024 (330:122g) | Advanced CAD and Modeling | |
| TECH 3147 (330:147) | Computer Aided Manufacturing | |

| | | |
|------------------------------|---|--|
| Mathematics: | | |
| ACT SCI/MATH 3780 | Mathematics of Finance | |
| ACT SCI 4735/5735 (800:153g) | Actuarial Mathematics | |
| ACT SCI 4739/5739 (800:158g) | Topics in Actuarial Science, Topics in Actuarial Science: Long-Term Actuarial Mathematics | |
| ACT SCI 4785/5785 (800:197g) | Introduction to Financial Engineering | |
| ACT SCI 4788/5788 (800:170g) | Loss Models | |
| MATH 3425/5425 (800:149g) | Differential Equations | |
| MATH 3430/5430 (800:150g) | Partial Differential Equations | |
| MATH 3440/5440 (800:176g) | Numerical Analysis | |
| MATH 3530/5530 (800:143g) | Combinatorics | |

| | |
|------------------------------|---|
| MATH 3630/5630 (800:155g) | Differential Geometry |
| MATH/STAT 3752 | Introduction to Probability |
| MATH 4460/5460 (800:156g) | Introduction to Complex Analysis |
| MATH 6746 (800:251) | Probabilistic Operations Research |
| MATH 6748 (800:253) | Modeling Industrial Systems Using Queueing Networks |
| MATH 6779 (800:273) | Topics in Probability and Statistics |
| STAT 3771/5771 (800:121g) | Applied Statistical Methods for Research |
| STAT 3775/5775 (800:174g) | Introduction to Mathematical Statistics |
| STAT 3776/5776 (800:175g) | Regression Analysis |
| STAT 3778/5778 (800:171g) | Spatial Data Analysis |
| STAT 4772/5772 (800:122g) | Statistical Computing I |
| STAT 4773/5773 (800:123g) | Design and Analysis of Experiments |
| STAT 4777/5777 (800:157g) | Statistical Quality Assurance Methods |
| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis |
| STAT 4782/5782 | Statistical Computing II |
| STAT 6772 (800:272) | Advanced Statistical Methods |
| Computer Science: | |
| CS 3470/5470 (810:147g) | Networking |
| CS 6400 (810:240) | Computer Systems |
| Physics: | |
| PHYSICS 6100 (880:205) | Modeling and Simulation of Physical Systems |
| Total Hours | 30 |

Program Certificates

The University of Northern Iowa makes available, in addition to traditional programs, the opportunity for students to earn program certificates. Program certificates provide an alternative to programs leading to a degree, a major, or a minor; they certify that an individual has completed a program approved by the university. For information on the following certificates, contact the Department of Mathematics or the Office of the Registrar, which serves as the centralized registry.

Statistical Computing Certificate

Required:

| | | |
|---------------------------------------|--|---|
| STAT 3771/5771 (800:121g) | Applied Statistical Methods for Research | 3 |
| STAT 4772/5772 (800:122g) | Statistical Computing I | 3 |
| STAT 4782/5782 | Statistical Computing II | 3 |
| Electives: 6 hours from the following | | 6 |

| | |
|--|---|
| STAT 3776/5776 (800:175g) | Regression Analysis |
| STAT 3778/5778 (800:171g) | Spatial Data Analysis |
| STAT 4773/5773 (800:123g) | Design and Analysis of Experiments |
| STAT 4779/5779 (800:196g) | Applied Multivariate Statistical Analysis |
| Any other courses with the consent of the mathematics department | |
| Total Hours | 15 |

Mathematics, B.A.

Goal 1. Problem Solving Specification:

1. Understanding: Students will understand or state problems and definitions correctly;
2. Modification: Students will modify problems when necessary to make them tractable;
3. Reaching a solution: Students will articulate assumptions and reason logically to conclusions;
4. Communication and Interpretation: Students will communicate steps and interpret results intelligently when necessary.

Goal 2. Content Specification:

1. Knowledge Foundation: Students will demonstrate an understanding of the core knowledge of mathematics.
2. Advanced Content: Students will demonstrate comprehension of upper-level content of mathematics, statistics and actuarial science.
3. Communication and Interpretation: Students will communicate using correct content terms and interpret concepts when necessary.

Goal 3. Technology/Software:

1. Software Proficiency: Students will demonstrate basic proficiency with mathematical and statistical software.
2. Analytical Skills: Students will be able to make informed choices about when the use of technology or data analysis is viable and useful.
3. Communication and Interpretation: Students will communicate using the right language and interpret results intelligently.

Goal 4. Professional Development:

1. Proof and Argument Specification: Students will be able to compose and explain proofs in clear mathematical style, both orally and in writing, and to critically evaluate mathematical arguments made by others. Students will be able to use a variety of techniques of proof, including direct proof, proof by contradiction, and mathematical induction.

Mathematics: Statistics/Actuarial Science, B.A.

Goal 1. Problem Solving Specification:

1. Understanding: Students will understand or state problems and definitions correctly;
2. Modification: Students will modify problems when necessary to make them tractable;

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3. Reaching a solution: Students will articulate assumptions and reason logically to conclusions;
4. Communication and Interpretation: Students will communicate steps and interpret results intelligently when necessary.

Goal 2. Content Specification:

1. Knowledge Foundation: Students will demonstrate an understanding of the core knowledge of mathematics.
2. Advanced Content: Students will demonstrate comprehension of upper-level content of mathematics, statistics and actuarial science.
3. Communication and Interpretation: Students will communicate using correct content terms and interpret concepts when necessary.

Goal 3. Technology/Software:

1. Software Proficiency: Students will demonstrate basic proficiency with mathematical and statistical software.
2. Analytical Skills: Students will be able to make informed choices about when the use of technology or data analysis is viable and useful.
3. Communication and Interpretation: Students will communicate using the right language and interpret results intelligently.

Goal 4. Professional Development:

1. Actuarial Science Development: Students with actuarial science emphasis will develop skills and acquire the content knowledge needed to pass actuarial exams offered by the professional organizations including Society of Actuaries and Casualty Actuarial Society.

Mathematics Teaching, B.A.

Goal 1: Social Contexts of Mathematics Teaching and Learning - Well-prepared beginning teachers of mathematics realize that the social, historical, and institutional contexts of mathematics affect teaching and learning and know about and are committed to their critical roles as advocates for each and every student.

Goal 2: Knowledge of Students as Learners of Mathematics - Well-prepared beginning teachers of mathematics have foundational understandings of students' mathematical knowledge, skills, and dispositions. They also know how these understandings can contribute to effective teaching and are committed to expanding and deepening their knowledge of students as learners of mathematics.

Goal 3: Pedagogical Knowledge and Practices for Teaching Mathematics - Well-prepared beginning teachers of mathematics have foundations of pedagogical knowledge, effective and equitable mathematics teaching practices to support students' sense making, understanding, and reasoning. Additionally, well-prepared beginning teachers can develop effective assessment plans.

Goal 4: Knowledge of Mathematics Well-prepared beginning teachers of mathematics possess robust knowledge of mathematical and statistical concepts that underlie what they encounter in teaching. They engage in appropriate mathematical and statistical practices and support their students in doing the same.

Mathematics, M.A.

Goal 1. Graduates will be able to undertake advanced mathematical reasoning:

- a. Students will construct logically valid mathematical arguments;
- b. Students will apply information learned in one setting to different situations;
- c. Students will make connections between seemingly different concepts.

Goal 2. Graduates will be able to conduct independent work and develop new mathematical ideas:

- a. Students will demonstrate that they can work independently;
- b. Students will identify problems in their readings and to find ways to fix them;
- c. Students will create original method(s) for solving known problem(s) or find solution(s) to new problem(s) in their theses or culminating papers.

Goal 3. Graduates will be able to solve problems at the level of graduate mathematics:

- a. Students will use/apply research-level (advanced) methods used to solve problems in their theses or culminating papers;
- b. Students will solve problems in graduate courses. Department faculty will identify 1-2 problems on the final examinations to assess this goal.

Goal 4. Graduates will be able to comprehend and communicate advanced mathematics both orally and in writing:

- a. Students will clearly state the goal(s) of their theses or paper;
- b. Students will place the questions/problems they addressed in their theses or papers in context (history, literature review, etc);
- c. Students will describe in detail the method(s) they used to answer the questions/problems in their theses or papers;
- d. Students will demonstrate mastery of the subject matter covered in their theses by answering questions from the theses committees about the theses.

Mathematics Emphasis in Secondary Teaching or Community College Teaching, M.A.

Goal 1: Use evidence from teaching to analyze current practices and work to improve future teaching through the Mathematical Teaching Practices

Goal 2: Demonstrate proficiency in mathematics oriented toward deepening mathematical knowledge

Goal 3: Incorporate mathematics education research and resources (e.g. curriculum, current and emerging technology, manipulatives) into teaching practices

Goal 4: Explore equitable teaching practices from theory through implementation

Goal 5: Analyze current assessment practices through the lens of current assessment research

Mathematics for the Elementary and Middle Grades (K-8), M.A.

In working to develop a productive mathematical disposition for teaching, students will

a. Use evidence from teaching to analyze current practices and work to improve future teaching through the following Mathematical Teaching Practices:

1. Establish mathematics goals to focus learning
2. Implement tasks that promote reasoning and problem solving
3. Use and connect mathematical representations
4. Facilitate meaningful mathematical discourse
5. Pose purposeful questions
6. Build procedural fluency from conceptual understanding
7. Support productive struggle in learning mathematics
8. Elicit and use evidence of student thinking.

b. Demonstrate proficiency in mathematics oriented toward deepening mathematical knowledge.

c. Incorporate mathematics education research and resources (e.g. curriculum, current and emerging technology, manipulatives) into teaching practices.

d. Explore equitable teaching practices from theory through implementation.

e. Analyze current assessment practices through the lens of current assessment research.

Industrial Mathematics, P.S.M.

1. Students will demonstrate an in-depth understanding of a variety of mathematical models and techniques needed in business/industry.

2. Students will demonstrate the practical skills needed to apply mathematical models and techniques to problem-solving in business/industry.

3. Students will demonstrate communication skills appropriate for working

in business/industry.