

# MATHEMATICS: MATHEMATICS FOR STATISTICAL ANALYSIS AND RISK ASSESSMENT

The Mathematics major's named options allow students to develop a deep understanding of how the subject relates to other areas of human inquiry. The requirements for these options feature mathematics courses with topics inspired by and commonly applied to problems in these associated fields. Though often paired with a second major in a related area, these programs function well alone and are suited to any mathematics student with a variety of interests. Students interested in a named option are recommended to meet with an advisor to navigate the various plans and courses available to them. Advising information can be found on the BA or BS pages (<https://guide.wisc.edu/undergraduate/letters-science/mathematics/mathematics-ba/#advisingandcareerstext>).

The named options do not support Honors in the Major.

## REQUIREMENTS

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The Mathematics for Statistical Analysis and Risk Assessment program requires 10 distinct courses for at least 30 credits as described below. Note that while some courses may be used to fulfill more than one requirement it is still considered only a single course and may only contribute once to the total course count. Finally, at most one course from each of the following groupings may be used to fulfill the minimum course and credit requirement (i.e.: minimum of ten courses and at least 30 credits): Intro Linear Algebra (MATH 320, MATH 340, MATH 341, MATH 375), Intro Differential Equations (MATH 319, MATH 320 or MATH 376), and Intro Probability (MATH/STAT 309 or MATH/STAT 431).

| Code                                                                                                    | Title                                                     | Credits |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------|
| <b>Core Math Requirement (minimum of six distinct MATH courses for at least 18 credits)<sup>1</sup></b> |                                                           |         |
| <i>Linear Algebra</i>                                                                                   |                                                           | 3-5     |
| MATH 341                                                                                                | Linear Algebra                                            |         |
| or MATH 320                                                                                             | Linear Algebra and Differential Equations                 |         |
| or MATH 340                                                                                             | Elementary Matrix and Linear Algebra                      |         |
| or MATH 375                                                                                             | Topics in Multi-Variable Calculus and Linear Algebra      |         |
| <i>Probability (Complete at least one)</i>                                                              |                                                           | 3       |
| MATH/STAT 431                                                                                           | Introduction to the Theory of Probability                 |         |
| or MATH/STAT 309                                                                                        | Introduction to Probability and Mathematical Statistics I |         |
| MATH 531                                                                                                | Probability Theory                                        |         |
| <i>Statistics<sup>1</sup></i>                                                                           |                                                           | 3       |

|                                                                                |                                                                                                                                  |     |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-----|
| MATH/STAT 310                                                                  | Introduction to Probability and Mathematical Statistics II (Statistics)                                                          |     |
| <i>Intermediate Mathematics Requirement (complete at least one)</i>            |                                                                                                                                  | 0-6 |
| MATH 341<br>or MATH 375                                                        | Linear Algebra<br>Topics in Multi-Variable Calculus and Linear Algebra                                                           |     |
| MATH 421                                                                       | The Theory of Single Variable Calculus                                                                                           |     |
| MATH 321<br>& MATH 322                                                         | Applied Mathematical Analysis 1: Vector and Complex Calculus and Applied Mathematical Analysis 2: Partial Differential Equations |     |
| <i>Advanced Mathematics Requirement (select one)</i>                           |                                                                                                                                  | 3   |
| MATH/COMP SCI 514                                                              | Numerical Analysis                                                                                                               |     |
| MATH 521                                                                       | Analysis I                                                                                                                       |     |
| MATH 531                                                                       | Probability Theory                                                                                                               |     |
| MATH 535                                                                       | Mathematical Methods in Data Science                                                                                             |     |
| MATH 540                                                                       | Linear Algebra II                                                                                                                |     |
| <i>Electives to reach required six courses for at least 18 credits in MATH</i> |                                                                                                                                  | 3-6 |
| At least one elective must come from: <sup>2</sup>                             |                                                                                                                                  |     |
| MATH/COMP SCI 513                                                              | Numerical Linear Algebra                                                                                                         |     |
| MATH/COMP SCI 514                                                              | Numerical Analysis                                                                                                               |     |
| MATH 519                                                                       | Ordinary Differential Equations                                                                                                  |     |
| MATH 521                                                                       | Analysis I                                                                                                                       |     |
| MATH 522                                                                       | Analysis II                                                                                                                      |     |
| MATH/COMP SCI/ISYE/STAT 525                                                    | Linear Optimization                                                                                                              |     |
| MATH 531                                                                       | Probability Theory                                                                                                               |     |
| MATH 535                                                                       | Mathematical Methods in Data Science                                                                                             |     |
| MATH 540                                                                       | Linear Algebra II                                                                                                                |     |
| MATH 541                                                                       | Modern Algebra                                                                                                                   |     |
| MATH 542                                                                       | Modern Algebra                                                                                                                   |     |
| MATH 616                                                                       | Data-Driven Dynamical Systems, Stochastic Modeling and Prediction                                                                |     |
| MATH 619                                                                       | Analysis of Partial Differential Equations                                                                                       |     |
| MATH 627                                                                       | Introduction to Fourier Analysis                                                                                                 |     |
| MATH 629                                                                       | Introduction to Measure and Integration                                                                                          |     |
| MATH/ISYE/OTM/STAT 632                                                         | Introduction to Stochastic Processes                                                                                             |     |
| MATH 635                                                                       | An Introduction to Brownian Motion and Stochastic Calculus                                                                       |     |
| Remaining courses/credits may be selected from:                                |                                                                                                                                  |     |
| MATH 319                                                                       | Techniques in Ordinary Differential Equations                                                                                    |     |
| MATH 321                                                                       | Applied Mathematical Analysis 1: Vector and Complex Calculus                                                                     |     |

|                           |                                                                 |
|---------------------------|-----------------------------------------------------------------|
| MATH 322                  | Applied Mathematical Analysis 2: Partial Differential Equations |
| MATH 376                  | Topics in Multi-Variable Calculus and Differential Equations    |
| MATH 415                  | Applied Dynamical Systems, Chaos and Modeling                   |
| MATH 421                  | The Theory of Single Variable Calculus                          |
| MATH/COMP SCI/ I SY E 425 | Introduction to Combinatorial Optimization                      |
| MATH/COMP SCI/ E C E 435  | Introduction to Cryptography                                    |
| MATH 443                  | Applied Linear Algebra                                          |
| MATH 444                  | Graphs and Networks in Data Science                             |
| MATH 467                  | Introduction to Number Theory                                   |
| MATH/COMP SCI/ STAT 475   | Introduction to Combinatorics                                   |

**Statistics/Risk Requirement (Four Courses distinct from the above for at least 12 credits)<sup>3</sup>**

Select a distinct introduction course or sequence: 3-6

*Actuarial Sciences:*

ACT SCI 303 Theory of Interest

*Statistics:*

STAT 333 & STAT/M E 424 Applied Regression Analysis and Statistical Experimental Design

*Data Science:*

STAT 340 & STAT/M E 424 Data Science Modeling II and Statistical Experimental Design

Select remaining courses/credits from:<sup>4</sup> 6-14

ACT SCI 650 Fundamentals of Long-Term Actuarial Modeling

ACT SCI 651 Advanced Long-Term Actuarial Modeling

ACT SCI 652 Fundamentals of Short-Term Actuarial Modeling

ACT SCI 653 Advanced Short-Term Actuarial Modeling

ACT SCI 654 Regression and Time Series for Actuaries

ACT SCI 655 Health Analytics

GEN BUS 656 Foundations of Statistical Learning for Business Analytics

STAT 349 Introduction to Time Series

STAT 351 Introductory Nonparametric Statistics

STAT 411 An Introduction to Sample Survey Theory and Methods

STAT 421 Applied Categorical Data Analysis

STAT 451 Introduction to Machine Learning and Statistical Pattern Classification

STAT 453 Introduction to Deep Learning and Generative Models

|                                 |                                          |
|---------------------------------|------------------------------------------|
| STAT 456                        | Applied Multivariate Analysis            |
| STAT 461                        | Financial Statistics                     |
| STAT/COMP SCI 471               | Introduction to Computational Statistics |
| STAT/COMP SCI/ MATH 475         | Introduction to Combinatorics            |
| STAT/COMP SCI/ I SY E/ MATH 525 | Linear Optimization                      |
| STAT 575                        | Statistical Methods for Spatial Data     |
| STAT/ I SY E/ MATH/ OTM 632     | Introduction to Stochastic Processes     |
| STAT/ B M I 641                 | Statistical Methods for Clinical Trials  |
| STAT/ B M I 642                 | Statistical Methods for Epidemiology     |
| M E 536                         | Data Driven Engineering Design           |

**Total Credits 30**

## RESIDENCE AND QUALITY OF WORK

- 2.000 GPA on all MATH courses and courses eligible for the major.<sup>5</sup>
- 2.000 GPA on at least 15 credits of upper level credit in the major.<sup>6</sup>
- 15 credits in MATH in the major taken on the UW-Madison campus.<sup>7</sup>

## FOOTNOTES

- <sup>1</sup> Students taking STAT 312 to satisfy the Statistics requirement will not be able to use this course towards the six courses/18 credits of MATH courses.
- <sup>2</sup> This course must be distinct from the advanced mathematics requirement.
- <sup>3</sup> The courses which follow may have prerequisites outside of this program.
- <sup>4</sup> Any MATH course from the elective list above may be used in lieu of any of the following courses.
- <sup>5</sup> This includes any course with a MATH prefix (or cross-listed with MATH) regardless of its appearance in the tables above and any non-MATH course explicitly listed in the tables above.
- <sup>6</sup> This includes any MATH course (including those crosslisted with MATH) which are numbered 307 and above, regardless of its appearance in the tables above, as well as only those non-MATH course which appear in the tables above and have the advanced LAS attribute.
- <sup>7</sup> This includes any MATH course (and those crosslisted with MATH) numbered 307 and above.

## FOUR-YEAR PLAN

### FOUR-YEAR PLAN

This Four-Year Plan is only one way a student may complete an L&S degree with this major. Many factors can affect student degree planning, including placement scores, credit for transferred courses, credits earned by examination, and individual scholarly interests. In addition, many students have commitments (e.g., athletics, honors, research, student organizations, study abroad, work and volunteer experiences) that necessitate they adjust their plans accordingly. Informed students engage in their own unique Wisconsin Experience by consulting their academic

advisors, Guide, DARS, and Course Search & Enroll for assistance making and adjusting their plan.

in this named option, but STAT 301, STAT 371, and ECON 310 also satisfy the prerequisite.

In general, your four year plan in mathematics should be organized along the following sequence:

1. Calculus
2. Linear Algebra
3. Required Intermediate Mathematics course
4. Additional 300/400-level MATH courses as needed
5. Required Advanced Mathematics course
6. Additional 500/600-level MATH course(s)

### Freshman

| Fall                           | Credits Spring                   | Credits   |
|--------------------------------|----------------------------------|-----------|
| MATH 221                       | 5 MATH 222                       | 4         |
| Literature Breadth             | 3 Literature Breadth             | 3         |
| Communication A                | 3 Ethnic Studies                 | 3         |
| Foreign Language (if required) | 4 Foreign Language (if required) | 4         |
|                                | <b>15</b>                        | <b>14</b> |

### Sophomore

| Fall                                        | Credits Spring                 | Credits   |
|---------------------------------------------|--------------------------------|-----------|
| MATH 234 <sup>1</sup>                       | 4 MATH Required Linear Algebra | 3         |
| Introductory Statistics course <sup>2</sup> | 3-4 MATH Required Probability  | 3         |
| Humanities Breadth                          | 3 Humanities Breadth           | 3         |
| Communication B                             | 3 Physical Science Breadth     | 3         |
| Physical Science Breadth                    | 3 Elective                     | 3         |
|                                             | <b>16</b>                      | <b>15</b> |

### Junior

| Fall                        | Credits Spring                | Credits   |
|-----------------------------|-------------------------------|-----------|
| MATH/STAT 310               | 3 Required Intermediate MATH  | 3         |
| Statistics/Risk course      | 3 Statistics/Risk course      | 3         |
| Social Sciences Breadth     | 3 Social Science Breadth      | 3         |
| Biological Sciences Breadth | 3 Biological Sciences Breadth | 3         |
| Elective                    | 3 Elective                    | 3         |
|                             | <b>15</b>                     | <b>15</b> |

### Senior

| Fall                   | Credits Spring                | Credits   |
|------------------------|-------------------------------|-----------|
| Required Advanced MATH | 3 500/600-level MATH Elective | 3         |
| Statistics/Risk course | 3 Statistics/Risk course      | 3         |
| Social Science Breadth | 3 Social Science Breadth      | 3         |
| Elective               | 3 Elective                    | 3         |
| Elective               | 3 Elective                    | 3         |
|                        | <b>15</b>                     | <b>15</b> |

**Total Credits 120**

<sup>1</sup> Students should declare their major upon the successful completion of this course

<sup>2</sup> To enroll in MATH/STAT 310, students must have an introductory statistics course. STAT 324 or STAT 240 are recommended for students