

# MATHEMATICS: MATHEMATICS FOR DATA SCIENCE

The mathematics named option programs allow students to develop a deep understanding of how the subject relates to other areas of human inquiry. The requirements for these programs 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 program 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 (<http://guide.wisc.edu/undergraduate/letters-science/mathematics/mathematics-ba/#advisingandcareerstext>).

The named options do not support honors in the major.

## REQUIREMENTS

The Mathematics for Data Science 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 only one course from each of the following groupings may be used to fulfill the minimum course and credit requirement (i.e.: requirements: 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)</b>		
<i>Linear Algebra</i>		3-5
MATH 340	Elementary Matrix and Linear Algebra	
or MATH 320	Linear Algebra and Differential Equations	
or MATH 341	Linear Algebra	
or MATH 375	Topics in Multi-Variable Calculus and Linear Algebra	
<i>Intermediate Mathematics Requirement (complete at least one)</i>		0-6
MATH 421	The Theory of Single Variable Calculus	
MATH 341	Linear Algebra	
MATH 321 & MATH 322	Applied Mathematical Analysis and Applied Mathematical Analysis	
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>Numerical and optimization methods (complete at least one)</i>		3
MATH/COMP SCI 513	Numerical Linear Algebra	
MATH/COMP SCI/I SY E/STAT 525	Linear Optimization	
MATH/COMP SCI 514	Numerical Analysis	
MATH 443	Applied Linear Algebra	
MATH/COMP SCI/I SY E 425	Introduction to Combinatorial Optimization	
<i>Mathematics of data</i>		3
MATH 535	Mathematical Methods in Data Science	
<i>Advanced Electives (complete at least one):</i>		0-3
MATH/COMP SCI 513	Numerical Linear Algebra	
MATH/COMP SCI 514	Numerical Analysis	
MATH 521	Analysis I	
MATH/COMP SCI/I SY E/STAT 525	Linear Optimization	
MATH 531	Probability Theory	
MATH 540	Linear Algebra II	
MATH/I SY E/OTM/STAT 632	Introduction to Stochastic Processes	
<i>Electives to reach required six courses for at least 18 credits in MATH<sup>1</sup></i>		0-6
MATH/STAT 310	Introduction to Probability and Mathematical Statistics II	
MATH/COMP SCI/I SY E 425	Introduction to Combinatorial Optimization	
MATH 443	Applied Linear Algebra	
MATH/COMP SCI 513	Numerical Linear Algebra	
MATH/COMP SCI 514	Numerical Analysis	
MATH 521	Analysis I	
MATH/COMP SCI/I SY E/STAT 525	Linear Optimization	
MATH 531	Probability Theory	
MATH 540	Linear Algebra II	
MATH/I SY E/OTM/STAT 632	Introduction to Stochastic Processes	
<b>Data Science Requirement (at least four courses for at least 12 credits)<sup>2</sup></b>		12
<i>Data Science Fundamentals (choose one)</i>		
STAT 340	Data Science Modeling II	

COMP SCI 320 Data Science Programming II

Remaining courses may be selected from below or from the MATH elective lists above.<sup>3</sup>

COMP SCI/E C E/ Introduction to Optimization  
I SY E 524

COMP SCI/  
E C E 533 Image Processing

COMP SCI/E C E/ Introduction to Artificial Neural  
M E 539 Networks

COMP SCI 540 Introduction to Artificial Intelligence

COMP SCI/  
E C E 561 Probability and Information Theory  
in Machine Learning

COMP SCI/  
B M I 567 Medical Image Analysis

COMP SCI/  
B M I 576 Introduction to Bioinformatics

STAT 351 Introductory Nonparametric  
Statistics

STAT 421 Applied Categorical Data Analysis

STAT/M E 424 Statistical Experimental Design

STAT 433 Data Science with R

STAT 443 Classification and Regression Trees

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/B M I 641 Statistical Methods for Clinical Trials

STAT/B M I 642 Statistical Methods for  
Epidemiology

ECON 400 Introduction to Applied  
Econometrics

ECON 410 Introductory Econometrics

ECON 570 Fundamentals of Data Analytics for  
Economists

I SY E 412 Fundamentals of Industrial Data  
Analytics

I SY E 612 Information Sensing and Analysis for  
Manufacturing Processes

**Total Credits**

**27-33**

## RESIDENCE AND QUALITY OF WORK

- 2.000 GPA on all MATH courses and courses eligible for the major.<sup>4</sup>
- 2.000 GPA on at least 15 credits of upper level credit in the major.<sup>5</sup>
- 15 credits in MATH in the major taken on the UW-Madison campus.<sup>6</sup>

## FOOTNOTES

1

Elective courses must be distinct from those used to fulfill the above requirements.

2

Courses below may have prerequisites outside of this program.

3

MATH courses must be distinct from any used to fulfill an above requirement.

4

This includes any course with a MATH prefix (or crosslisted with MATH) regardless of its appearance in the tables above and any non-MATH class explicitly listed in the tables above.

5

This includes any MATH course (including those crosslisted with MATH) numbered 307 and above, regardless of its appearance in the tables above, as well as only those non-MATH classes which appear in the tables above and have the advanced LAS attribute.

6

This includes any MATH course (and those crosslisted with MATH) numbered 307 and above.

## FOUR-YEAR PLAN

### SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

In general, your four year plan in mathematics should be organized along the following sequence: 1) Calculus, 2) Linear Algebra, 3) Required Intermediate level course, 4) Additional intermediate level courses as needed, 5) Required advanced level course, 6) Additional advanced level courses.

#### 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		4 Foreign Language	4
		<b>15</b>	<b>14</b>

#### Sophomore

Fall	Credits	Spring	Credits
MATH 234		4 MATH Required Linear Algebra	3
Humanities Breadth		3 MATH Required Probability	3
Communication B		3 Humanities Breadth	3
Prerequisite for Data Science Fundamentals course		3 Physical Science Breadth	3
Elective		3 Elective	3
		<b>16</b>	<b>15</b>

**Junior**

<b>Fall</b>	<b>Credits</b>	<b>Spring</b>	<b>Credits</b>
Required Intermediate MATH		3 MATH Elective	3
Data Science Fundamentals Course		3 Data Science Elective	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**

<b>Fall</b>	<b>Credits</b>	<b>Spring</b>	<b>Credits</b>
MATH 535		3 Advanced MATH elective	3
Data Science Elective		3 Data Science Elective	3
Social Science Breadth		3 Social Science Breadth	3
Electives		6 Electives	6
	<b>15</b>		<b>15</b>

**Total Credits 120**