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# MATHEMATICS: MATHEMATICS FOR PROGRAMMING AND COMPUTING

#### REQUIREMENTS

# REQUIREMENTS

The Mathematics for Programming and Computing program requires 10 distinct courses for at least 30 credits as described below. While a single courses may be used to fulfill more than one requirement, it will 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).

Core Math Requirement (minimum of six distinct MATH courses for at least 18 credits)Linear Algebra3-5MATH 341Linear Algebraor MATH 320Linear Algebra and Differential Equations or MATH 340or MATH 340Elementary Matrix and Linear Algebra or MATH 375Topics in Multi-Variable Calculus and Linear Algebra0-6one)MATH 321MATH 321Applied Mathematical Analysis & MATH 3220-6MATH 322and Applied Mathematical Analysis & MATH 3220-6MATH 321Applied Mathematical Analysis Linear Algebra0-6MATH 321Applied Mathematical Analysis & MATH 3250-6MATH 375Topics in Multi-Variable Calculus and Linear Algebra0-6MATH 375Topics in Multi-Variable Calculus and Linear Algebra0-6MATH 421The Theory of Single Variable Calculus0-6MATH 421Introduction to Number Theory3MATH 427Introduction to Number Theory3MATH 521Analysis I0-6MATH 521Analysis I0-6MATH 521Analysis I0-6MATH 535Mathematical Methods in Data Science0-6MATH 540Linear Algebra II0-6MATH 541Modern Algebra0-12MATH 541Modern Algebra0-12MATH 541Modern Algebra II0-12MATH 541Modern Algebra II0-12MATH 541Modern Algebra II0-12MATH 541Modern Algebra II0-12	Code	Title	Credits
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MATH 541     Modern Algebra       MATH/     Mathematical Logic       PHILOS 571     MATH Elective to reach required minimum of six courses for	MATH 535		
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PHILOS 571         MATH Elective to reach required minimum of six courses for       6-12	MATH 541	Modern Algebra	
	/	Mathematical Logic	
at least 18 credits	MATH Elective to rea at least 18 credits	ch required minimum of six courses for	6-12

MATH/ COMP SCI 513	Numerical Linear Algebra
MATH/ COMP SCI 514	Numerical Analysis
MATH 521	Analysis I
MATH 522	Analysis II
MATH/ COMP SCI/I SY E/ 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 567	Modern Number Theory
MATH 570	Fundamentals of Set Theory
MATH/ PHILOS 571	Mathematical Logic
MATH 605	
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/I SY E/ OTM/STAT 632	Introduction to Stochastic Processes
OTM/STAT 632	Processes An Introduction to Brownian Motion and Stochastic Calculus
OTM/STAT 632 MATH 635	Processes An Introduction to Brownian Motion and Stochastic Calculus burses from:
OTM/STAT 632 MATH 635 Select remaining co	Processes An Introduction to Brownian Motion and Stochastic Calculus ourses from: Introduction to Probability and
OTM/STAT 632 MATH 635 Select remaining cc MATH/STAT 310	Processes An Introduction to Brownian Motion and Stochastic Calculus burses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential
OTM/STAT 632 MATH 635 Select remaining co MATH/STAT 310 MATH 319	Processes An Introduction to Brownian Motion and Stochastic Calculus ourses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential Equations Topics in Multi-Variable Calculus and Differential
OTM/STAT 632 MATH 635 Select remaining co MATH/STAT 310 MATH 319 or MATH 376	Processes An Introduction to Brownian Motion and Stochastic Calculus ourses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential Equations Topics in Multi-Variable Calculus and Differential Equations
OTM/STAT 632 MATH 635 Select remaining co MATH/STAT 310 MATH 319 or MATH 376 MATH 321	Processes An Introduction to Brownian Motion and Stochastic Calculus aurses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential Equations Topics in Multi-Variable Calculus and Differential Equations Applied Mathematical Analysis
OTM/STAT 632 MATH 635 Select remaining co MATH/STAT 310 MATH 319 or MATH 376 MATH 321 MATH 322	Processes An Introduction to Brownian Motion and Stochastic Calculus Durses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential Equations Topics in Multi-Variable Calculus and Differential Equations Applied Mathematical Analysis Applied Mathematical Analysis Applied Dynamical Systems, Chaos
OTM/STAT 632 MATH 635 Select remaining co MATH/STAT 310 MATH 319 or MATH 376 MATH 321 MATH 322 MATH 415	Processes An Introduction to Brownian Motion and Stochastic Calculus Durses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential Equations Topics in Multi-Variable Calculus and Differential Equations Applied Mathematical Analysis Applied Mathematical Analysis Applied Dynamical Systems, Chaos and Modeling The Theory of Single Variable
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OTM/STAT 632 MATH 635 Select remaining co MATH/STAT 310 MATH 319 or MATH 376 MATH 321 MATH 322 MATH 415 MATH 415 MATH 421 MATH/ COMP SCI/ I SY E 425 MATH/STAT 431 or MATH/	Processes An Introduction to Brownian Motion and Stochastic Calculus Durses from: Introduction to Probability and Mathematical Statistics II Techniques in Ordinary Differential Equations Topics in Multi-Variable Calculus and Differential Equations Applied Mathematical Analysis Applied Mathematical Analysis Applied Dynamical Systems, Chaos and Modeling The Theory of Single Variable Calculus Introduction to Combinatorial Optimization
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At least one course must be from: <sup>1</sup>

MATH 444	Graphs and Networks in Data			
	Science			
MATH 467	Introduction to Number Theory			
MATH/ COMP SCI/ STAT 475	Introduction to Combinatorics			
Programming and Computations Requirement (Four Courses distinct from the above for at least 12 credits) <sup>2</sup>				
COMP SCI 300	Programming II	3		
COMP SCI 400	Programming III	3		
Elective <sup>3</sup>		6-8		
COMP SCI 412	Introduction to Numerical Methods			
COMP SCI/I SY E/ MATH 425	Introduction to Combinatorial Optimization			
COMP SCI/E C E/ MATH 435	Introduction to Cryptography			
COMP SCI/ STAT 471	Introduction to Computational Statistics			
COMP SCI/ MATH/STAT 475	Introduction to Combinatorics			
COMP SCI/ MATH 513	Numerical Linear Algebra			
COMP SCI/ MATH 514	Numerical Analysis			
COMP SCI 520	Introduction to Theory of Computing			
COMP SCI/E C E/ I SY E 524	Introduction to Optimization			
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization			
COMP SCI/ I SY E 526	Advanced Linear Programming			
COMP SCI/E C E/ M E 532	Matrix Methods in Machine Learning			
COMP SCI/ E C E 533	Image Processing			
COMP SCI 534	Computational Photography			
COMP SCI 538	Introduction to the Theory and Design of Programming Languages			
COMP SCI/E C E/ M E 539	Introduction to Artificial Neural Networks			
COMP SCI 540	Introduction to Artificial Intelligence			
COMP SCI/I SY E/ M E 558	Introduction to Computational			
COMP SCI 559	Geometry Computer Graphics			
COMP SCI/ B M I 567	Medical Image Analysis			
COMP SCI/ B M I 576	Introduction to Bioinformatics			
COMP SCI 577	Introduction to Algorithms			
COMP SCI/ I SY E 635	Tools and Environments for Optimization			
COMP SCI 642	Introduction to Information Security			
Total Credits		30		

### **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

- <sup>1</sup> This course must be distinct from the advanced mathematics requirement.
- $^{2}\,$  Courses below may have prerequisites outside of the requirements for this named option.
- $^{3}\,$  Any MATH course from the elective list above may be used in lieu of any of the following courses.
- 4 This includes any course with a MATH prefix (including those crosslisted with MATH) regardless of major program as well as only those non-MATH course explicitly listed in the tables above.
- $^{\rm 5}\,$  This includes any course with a MATH prefix (including those crosslisted with MATH) numbered 307 and above as well as only those non-MATH courses which appear in the tables above and carry the advanced LAS designation.
- $^{\rm 6}\,$  This includes only those courses with a MATH prefix (or crosslisted with MATH).

### 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 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 (if required)	4 Foreign Language (if required)	4
	15	14

#### Sophomore

Fall	Credits Spring	Credits
MATH 234 <sup>1</sup>	4 MATH Required Linear Algebra	3
Humanities Breadth	3 Required Intermediate MATH	3
Communication B	3 Humanities Breadth	3
Physical Science Breadth	3 Physical Science Breadth	3
Elective	3 Elective	3
	16	15
Junior		
Fall	Credits Spring	Credits
Intermediate MATH	3 Intermediate MATH	3
COMP SCI 300	3 COMP SCI 400	3
Social Sciences Breadth	3 L&S Breadth - Social Science	3
Biological Sciences Breadth	3 Biological Sciences Breadth	3
Elective	3 Elective	3
	15	15
Senior		
Fall	Credits Spring	Credits
Required Advanced MATH	3 Advanced MATH	3
Elective Programming/	3 Elective Programming/	3
Computations Course	Computations Course	
Social Science Breadth	3 Social Science Breadth	3
Elective	3 Elective	3
Elective	3 Elective	3
	15	15

#### Total Credits 120

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