MATHEMATICS: MATHEMATICS FOR THE PHYSICAL AND BIOLOGICAL SCIENCES

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 the Physical and Biological Sciences 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).

Code	Title	Credits
Core Math Requirement (minimum of six distinct MATH courses for at least 18 credits) [1]		
Linear Algebra		*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	
Differential Equations		*0-5*
MATH 319	Techniques in Ordinary Differential Equations	
or MATH 320	Linear Algebra and Differential Equations	
or MATH 322	Applied Mathematical Analysis 2: Partial Differential Equations	
or MATH 376	Topics in Multi-Variable Calculus and Differential Equations	
or MATH 415	Applied Dynamical Systems, Chaos and Modeling	
or MATH 519	Ordinary Differential Equations	
Intermediate Mathematics Requirement (complete one)		*0-6*
MATH 341	Linear Algebra	
or MATH 375	Topics in Multi-Variable Calculus and Linear Algebra	
MATH 421	The Theory of Single Variable Calculus	
MATH 321 & MATH 322	Applied Mathematical Analysis 1: Vector and Complex Calculus and Applied Mathematical Analysis 2: Partial Differential Equations	
Advanced Mathematics Requirement (complete one)		*3*
MATH/ COMP SCI 514	Numerical Analysis	
MATH 519	Ordinary Differential Equations	
MATH 521	Analysis I	
MATH 531	Probability Theory	
MATH 540	Linear Algebra II	
MATH 541	Modern Algebra	
MATH 551	Elementary Topology	
MATH 561	Differential Geometry	
MATH 619	Analysis of Partial Differential Equations	
MATH 623	Complex Analysis	
MATH Elective to reach six courses and 18 credits		**3-9**
At least one from: [1]		
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/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 551	Elementary Topology	
MATH 552	Elementary Geometric and Algebraic Topology	
MATH 561	Differential Geometry	
MATH 567	Modern Number Theory	
MATH 570	Fundamentals of Set Theory	
MATH/ PHILOS 571	Mathematical Logic	
MATH/B M I/ BIOCHEM/ BMOLCHEM 609	Mathematical Methods for Systems Biology	
MATH 616	Data-Driven Dynamical Systems, Stochastic Modeling and Prediction	
MATH 619	Analysis of Partial Differential Equations	

MATH 623	Complex Analysis
MATH 627	Introduction to Fourier Analysis
MATH 629	Introduction to Measure and Integration
MATH/I SY E/ OTM/STAT 632	Introduction to Stochastic Processes
MATH 635	An Introduction to Brownian Motion and Stochastic Calculus
Remaining courses/credits may be from:	
MATH/STAT 310	Introduction to Probability and Mathematical Statistics II
MATH 321	Applied Mathematical Analysis 1: Vector and Complex Calculus
MATH 322	Applied Mathematical Analysis 2: Partial 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/STAT 431	Introduction to the Theory of Probability
or MATH/ STAT 309	Introduction to Probability and Mathematical Statistics I
MATH 443	Applied Linear Algebra
MATH 444	Graphs and Networks in Data Science
MATH/ COMP SCI/ STAT 475	Introduction to Combinatorics

Natural/Biological Sciences Requirement (Four courses distinct from the above for at least 12 credits) [1]		**12-16**
PHYSICS 247	A Modern Introduction to Physics	
or PHYSICS 207	General Physics	
or PHYSICS 201	General Physics	
or E M A 201	Statics	
PHYSICS 248	A Modern Introduction to Physics	
or PHYSICS 208	General Physics	
or PHYSICS 202	General Physics	
Two additional courses from the following: [2]		
ASTRON 310	Stellar Astrophysics	
ASTRON 320	The Interstellar Medium	
ATM OCN 310	Dynamics of the Atmosphere and Ocean I	
ATM OCN 311	Dynamics of the Atmosphere and Ocean II	
ATM OCN 330	Physics of the Atmosphere and Ocean I	
ATM OCN 340	Physics of the Atmosphere and Ocean II	
BIOCORE 383	Cellular Biology	
CHEM 561	Physical Chemistry I	
or CHEM 665	Biophysical Chemistry	
CHEM 562	Physical Chemistry II	
COMP SCI 300	Programming II	
COMP SCI 310	Problem Solving Using Computers	
COMP SCI 320	Data Science Programming II	
COMP SCI 400	Programming III	
COMP SCI/I SY E/ MATH 425	Introduction to Combinatorial Optimization	
COMP SCI/ MATH/STAT 475	Introduction to Combinatorics	
COMP SCI/ MATH 513	Numerical Linear Algebra	
COMP SCI/ MATH 514	Numerical Analysis	
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	
GEOSCI/ G L E 350	Introduction to Geophysics: The Dynamic Earth	
GEOSCI/ CIV ENGR/ ENVIR ST/ G L E 444	Practical Applications of GPS Surveying	
GEOSCI/ G L E 537	Quantitative Methods for Geoscience	
GEOSCI/ G L E 594	Introduction to Applied Geophysics	
GEOSCI/ G L E 627	Hydrogeology	
PHYSICS 249	A Modern Introduction to Physics	
or PHYSICS 241	Introduction to Modern Physics	
or PHYSICS 205	Modern Physics for Engineers	
PHYSICS 311	Mechanics	
PHYSICS 321	Electric Circuits and Electronics	
PHYSICS 322	Electromagnetic Fields	
PHYSICS 323	Electromagnetic Fields	
PHYSICS 325	Optics	
PHYSICS/B M E/ H ONCOL/ MED PHYS 501	Radiation Physics and Dosimetry	
PHYSICS/E C E/ N E 525	Introduction to Plasmas	
PHYSICS 551	Solid State Physics	
PHYSICS 623	Electronic Aids to Measurement	
PHYSICS 625	Applied Optics	
STAT/MATH 310	Introduction to Probability and Mathematical Statistics II	
or STAT 312	Introduction to Theory and Methods of Mathematical Statistics II	
STAT 333	Applied Regression Analysis	
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/M E 424	Statistical Experimental Design
STAT/MATH 431	Introduction to the Theory of Probability
or STAT/ MATH 309	Introduction to Probability and Mathematical Statistics I
or STAT 311	Introduction to Theory and Methods of Mathematical Statistics I
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/I SY E/ MATH/OTM 632	Introduction to Stochastic Processes
BIOCHEM/B M I/ BMOLCHEM/ MATH 609	Mathematical Methods for Systems Biology
BIOCHEM/ BOTANY 621	Plant Biochemistry
BSE 249	Engineering Principles for Biological Systems
BSE 349	Quantitative Techniques for Biological Systems
BSE 364	Engineering Properties of Food and Biological Materials
BSE 365	Measurements and Instrumentation for Biological Systems
BSE/M E 475	Engineering Principles of Agricultural Machinery
B M E 310	Bioinstrumentation
B M E 315	Biomechanics
B M E 325	Applied Statistics for Biomedical Engineers
B M E 330	Engineering Principles of Molecules, Cells, and Tissues
B M E/H ONCOL/ MED PHYS/ PHYSICS 501	Radiation Physics and Dosimetry
B M E/M E 505	Biofluidics
B M E 520	Stem Cell Bioengineering
B M E/ MED PHYS 535	Introduction to Energy-Tissue Interactions
B M E 556	Systems Biology: Mammalian Signaling Networks
B M E/ MED PHYS 566	Physics of Radiotherapy
B M E/ MED PHYS 567	The Physics of Diagnostic Radiology
B M E/ MED PHYS 573	Mathematical Methods in Medical Physics
B M E/M E 615	Tissue Mechanics
CBE 255	Introduction to Chemical Process Modeling
CBE 310	Chemical Process Thermodynamics
CBE 320	Introductory Transport Phenomena
CBE 326	Momentum and Heat Transfer Operations
CIV ENGR 310	Fluid Mechanics
CIV ENGR 311	Hydroscience
CIV ENGR 322	Environmental Engineering Processes
CIV ENGR 340	Structural Analysis I
CIV ENGR 370	Transportation Engineering
E C E 220	Electrodynamics I
E C E 230	Circuit Analysis
E C E/ PHYSICS 235	Introduction to Solid State Electronics
E C E 320	Electrodynamics II
E C E 330	Signals and Systems
E C E/COMP SCI/ MATH 435	Introduction to Cryptography
E C E/M E 441	Kinematics, Dynamics, and Control of Robotic Manipulators
E M A 202	Dynamics
E M A 303	Mechanics of Materials
E M A 405	Practicum in Finite Elements
E M A/E P 471	Intermediate Problem Solving for Engineers
E M A/E P 547	Engineering Analysis I
E M A/E P 548	Engineering Analysis II
E M A/ ASTRON 550	Astrodynamics
I SY E 320	Simulation and Probabilistic Modeling
I SY E 323	Operations Research-Deterministic Modeling
I SY E 516	Introduction to Decision Analysis
I SY E/COMP SCI/ E C E 524	Introduction to Optimization
I SY E/COMP SCI/ MATH/STAT 525	Linear Optimization
I SY E/ COMP SCI 526	Advanced Linear Programming
M S & E 330	Thermodynamics of Materials
M S & E 331	Transport Phenomena in Materials
M S & E 332	Macroprocessing of Materials
M S & E 434	Introduction to Thin-Film Deposition Processes
M S & E 460	Introduction to Computational Materials Science and Engineering
M E 331	Computer-Aided Engineering
M E 340	Dynamic Systems
M E 361	Thermodynamics
M E/STAT 424	Statistical Experimental Design
M E 446	Introduction to Feedback Control
M E 536	Data Driven Engineering Design

N E 305	Fundamentals of Nuclear Engineering
N E/E C E/ PHYSICS 525	Introduction to Plasmas
N E/I SY E 574	Methods for Probabilistic Risk Analysis of Nuclear Power Plants
MED PHYS/ B M E/H ONCOL/ PHYSICS 501	Radiation Physics and Dosimetry
MED PHYS/ B M E 535	Introduction to Energy-Tissue Interactions
MED PHYS 563	Radionuclides in Medicine and Biology
MED PHYS/ B M E 567	The Physics of Diagnostic Radiology
MED PHYS/ N E 569	Health Physics and Biological Effects
Total Credits	**30**

RESIDENCE AND QUALITY OF WORK

- 2.000 GPA for all MATH courses and courses eligible for the major.[3]
- 2.000 GPA on at least 15 credits of upper level credit in the major.[4]
- 15 credits in MATH in the major taken on the UW-Madison campus.[5]

FOOTNOTES

1 Courses listed in the tables below may have prerequisites outside of the program requirements.

2 Any MATH course from the elective list above may be used in lieu of any of the following courses.

3 This includes any course with the MATH prefix (or cross-listed with MATH) regardless of appearing in the tables above as well as only those non-MATH courses which appear in the tables above.

4 This includes any MATH courses (or courses cross-listed with MATH) numbered 307 and above, regardless of appearing in the tables above, as well as any non-MATH course listed in the tables above which carries the advanced LAS designation.

5 This includes any course with the MATH prefix (or cross-listed with MATH) numbered 307 and above.

FOUR-YEAR PLAN

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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 Math course (or sequence)
4. Additional 300/400-level courses as needed
5. Required Advanced Math course
6. Additional 500/600-level 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
	15		**14**

Sophomore

Fall	Credits	Spring	Credits
MATH 234[1]	4	MATH 321	3
MATH 320	3	Humanities Breadth	3
Humanities Breadth	3	Social Sciences Breadth	3
Communication B	3	Elective	3
Elective	3	Elective	3
	16		**15**

Junior

Fall	Credits	Spring	Credits
300/400-level MATH elective	3	MATH 322	3
PHYSICS 247, 207, 201, or E M A 201	5	PHYSICS 248, 208, or 202	5
Social Sciences Breadth	3	Biological Sciences Breadth	3
Biological Sciences Breadth	3	INTER-LS 210	1
		Elective	3
	14		**15**

Senior

Fall	Credits	Spring	Credits
Required Advanced MATH	3	500/600-level MATH elective	3
Natural/Biological requirement elective	3	Natural/Biological requirement elective	3
Social Sciences Breadth	3	Social Sciences Breadth	3
Elective	4	Elective	3
Elective	3	Elective	3
	16		**15**

Total Credits 120

FOOTNOTES

1 Students should declare their major upon the successful completion of this course