COLLEGE OF ARTS AND SCIENCES

MATHEMATICS

Faculty

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Program Goals

- **Critical Thinking**
  - To develop the cognitive and affective skills to address previously unsolved problems.
  - In all courses, to construct well-reasoned arguments with no gaps, and critique the arguments of others. In more advanced courses, to learn to read and construct valid mathematical proofs, and critique proofs constructed by others.
  - To learn appropriate uses of technology at all levels.
  - In all courses, to develop competencies in the core curriculum of mathematics that prepare students for success in a major program. For majors, to develop competencies in the core curriculum of mathematics that prepare students for success in a graduate program or mathematically-focused career.
- **Creativity**
  - To appreciate the sociocultural context of mathematics and its role in human cultures and societies.
  - To experience the beauty, creativity, and power of mathematics.
  - To develop students' identity as mathematicians, doers of mathematics, and members of mathematical communities.
- **Collaboration**
  - To offer curricular and co-curricular opportunities for student leadership and collaboration.
  - To collaborate with others in posing and addressing problems.
- **Communication**
  - To learn how to effectively communicate one's mathematical ideas in words, symbols, numbers, and diagrams, both orally and in writing.
  - To communicate mathematics at appropriate levels with others inside and outside of the mathematical community.
- **Global Responsibility**
  - To engage the community through applying mathematical knowledge, service learning, internships, and other opportunities.
  - To experience non-Western-European mathematics as equally valid forms of mathematical practice.
  - To appreciate the contributions of mathematicians from historically minoritized, oppressed, and/or non-European backgrounds.
- **Career Planning**
  - To learn about career opportunities and internships in mathematics and related fields.

Objectives

The Mathematics Program offers an academic major, minor, and applied minor as well as an elementary teaching minor. The curriculum in mathematics at Westminster meets the needs of students preparing to teach mathematics, students planning on graduate studies, students desiring to pursue non-teaching degrees in mathematics, students majoring in other academic disciplines who need a mathematics foundation, and students desiring practice in the art of logical thinking.

Program Requirements

Students must maintain a minimum cumulative 2.5 GPA in courses (excluding the world language requirement) required for both the academic major and minors and the teaching minors. For students seeking a mathematics teaching Level 2 endorsement, each course grade must be at least C. No more than six (6) credit hours from May term courses may be applied to the elective upper division mathematics requirement for the academic major. Prerequisite courses must be satisfied with a grade of C- or better. Students enrolled in mathematics courses without the required prerequisites may be withdrawn by the instructor.

Students must meet the university-wide graduation requirements in addition to the Mathematics major:

- 124 total hours
- 30 upper division hours
- WCore or Honors College requirements

Mathematics Major

Requirement Description	Credit Hours	Prerequisites
I. World Language Requirement	**8**	
Mathematics majors must complete eight credit hours in a single world language.		
II. Lower Division Courses	**24**	
DATA 220 Modern Statistics	4	

Requirement Description	Credit Hours	Prerequisites
MATH 201 Calculus I (if needed)	4	MATH 144 or placement test
MATH 202 Calculus II	4	MATH 201 or placement test
MATH 203 Multivariate Calculus	4	MATH 202
MATH 210 Discrete Mathematics	4	
WCSAM 203 Linear Algebra	4	
III. Upper Division Courses	**10**	
MATH 312 Abstract Algebra	4	MATH 210
MATH 321 Advanced Calculus	4	MATH 201, 210
Choose one of the following:		
MATH 485 or Senior Seminar or	2	Senior standing or consent of instructor
WCSAM 400 Science Capstone (by advisor approval)	2	
IV. Electives	**15**	
Additional upper-division coursework in MATH (fifteen). Students may apply at most six credits of May term hours toward the upper division elective requirement.		
V. Required Courses from Other Programs	**8-10**	
PHYS 211 Physics for Scientists and Engineers I and Lab (or 4 or 5 on the AP Physics C: Mechanics Exam)	4	MATH 144; Co-requisite: MATH 201
Computational Requirement: Choose one option from the following list*		
CMPT 201 Introduction to Computer Science	4	
CMPT 202 Intro to Data Structures	4	CMPT 201 OR CMPT 210
CMPT 190 AND DATA 360 Learning to Code (Python) AND Data Science with Python	2 AND 4	No prerequisite AND DATA 220
CMPT 190 AND BIOL/CHEM/PHYS 370 Learning to Code (Python) AND Scientific Computing	2 AND 4	No prerequisite AND CMPT 190 and PHYS 151 or 211
Total Hours for the Mathematics Major	**65-67**	

*Note: "Double-dipping" is allowed for the computational requirement. For example, a Computer Science major can use credit for CMPT 201 or CMPT 202 to meet this requirement. A Data Science minor can use DATA 360 to satisfy this requirement. However, a student cannot use DATA 360 both to satisfy this requirement and receive upper-division elective credit in Section IV above for the MATH major.

Recommended Plan of Study

Listed below is a suggested plan of study for completing the mathematics course requirements. Students should check with their advisors at least once a year as course offerings may change from what is listed. Students must also meet university-wide requirements for graduation.

	Fall Semester	Spring Semester
Year 1	DATA 220 or Computational Requirement MATH 201	MATH 202 MATH 210
Year 2	DATA 220 or Computational Requirement MATH 203	WCSAM 203 MATH elective (upper division)
Year 3	MATH elective (upper division) PHYS 211	MATH 312 MATH elective (upper division)
Year 4	MATH 321 MATH elective (upper division)	MATH 485

Mathematics Minor

Requirement Description	Credit Hours	Prerequisites
I. Required Courses	**20**	
DATA 220 Modern Statistics	4	
MATH 201 Calculus I (if needed)	4	MATH 144 or placement test
MATH 202 Calculus II	4	MATH 201 or placement test
MATH 210 Discrete Mathematics	4	
WCSAM 203 Linear Algebra	4	
II. Elective Courses	**7**	
Chosen from MATH 203 Multivariate Calculus and upper-division coursework in MATH		
Total Hours for the Mathematics Minor	**27**	

Applied Minor

Students may count credit hours in sections I and II below toward this minor and toward completion of a major. In other words, this is an exception to the university policy that disallows double-counting of elective courses.

Requirement Description	Credit Hours	Prerequisites
I. Required Courses	**12**	
DATA 220 Modern Statistics	4	
MATH 201 Calculus I	4	MATH 144 or placement test
WCSAM 203 Linear Algebra	4	
II. Upper Division Courses	**4**	
Take one of the following courses, from any of the groups: Computation		
BIOL/CHEM/PHYS 370 Scientific Computing	4	CMPT 190 and PHYS 151 or 211
CMPT 306 Algorithms	4	CMPT 202, MATH 210
MATH 362 Topics in Applied Mathematics	4	MATH 201 and WCSAM 203, MATH 211, or PHYS 309
Economics/Finance		

Requirement Description	Credit Hours	Prerequisites
ECON 499 Introduction to Econometrics	4	ECON 253 or 263, and either DATA 150 or DATA 220
FINC 305 Investments and Analysis	4	FINC 300
Science		
MATH 363 Differential Equations	4	MATH 202
PHYS 309 Mathematical Methods of Physics	4	MATH 202, PHYS 211
Statistics		
MATH 310 Probability and Statistics	4	MATH 202
PSYC 390 Quantitative Research Methods	4	DATA 220, PSYC 270
PUBH 305 Epidemiology	4	PUBH 101, 210
III. Electives	**10**	
MATH 202 Calculus II	4	MATH 201 or placement test
MATH 203 Multivariate Calculus	4	MATH 202
MATH 210 Discrete Mathematics	4	
MATH 300 Special Topics in Mathematics designated as applied math topics	1-4	Instructor permission
MATH 308 Putnam Seminar	1	WCSAM 203 or MATH 211
MATH 310 Probability and Statistics	4	MATH 202
MATH 311 Linear Algebra II	4	MATH 210, WCSAM 203
MATH 321 Advanced Calculus	4	MATH 201, 210
MATH 362 Topics in Applied Mathematics	4	MATH 201 and WCSAM 203 or PHYS 309
MATH 363 Differential Equations	4	MATH 202
DATA 350 Statistical Modeling	4	DATA 220
DATA 370 Statistical Learning	4	DATA 350
Other MATH coursework as approved by the program chair		
Total Hours for the Applied Minor	**26**	

Elementary Teaching Minor (Level II)

Requirement Description	Credit Hours	Prerequisites
I. Required Courses	**23**	
EDUC 387 Methods of Teaching Secondary School Math	3	
MATH 201 Calculus I	4	MATH 144 or placement test
MATH 210 Discrete Mathematics	4	
MATH 314 Foundations of Geometry	4	MATH 201; pre- or co-requisite: MATH 210

Requirement Description	Credit Hours	Prerequisites
Take one course from the following group: DATA 150 or Data and Society or DATA 220 Modern Statistics	 4 4	
Total Hours for the Elementary Teaching Minor	**23**	

Placement in Mathematics Courses

A member of the mathematics faculty should be consulted for any questions about placement in mathematics courses.

Proper placement in mathematics is critical, especially for students registering for a freshman-level mathematics course. Students with questions regarding placement should consult with their academic advisors.

Students receiving scores of 4 or 5 on one of the calculus advanced placement examinations receive the following Westminster credit:

Exam	Score	Credit Given
Calculus AB	4-5	MATH 201 (4 credits)
Calculus BC	4-5	MATH 201 and MATH 202 (8 credits)