

# Mathematics

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## Mathematics Courses

### **Program Goals**

#### **Critical Thinking**

- To become effective problem solvers.
- In more advanced courses, to learn to read and construct valid mathematical proofs.
- To learn appropriate uses of technology at all levels.
- For majors, to achieve competency in the core curriculum of mathematics sufficient for success in a graduate program.

#### **Creativity**

- To gain an understanding of the historical development of mathematics and its role in the history of human civilization.
- To gain a greater appreciation of the beauty and power of mathematics.

#### **Collaboration**

- To offer curricular and co-curricular opportunities for student leadership and collaboration.

#### **Communication**

- To learn how to effectively communicate one's mathematical ideas, both in writing and orally.

#### **Global Responsibility**

- To engage the community through service learning and other opportunities.

#### **Career Planning**

- To learn about career opportunities 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 Students enrolled in mathematics courses without the required prerequisites may be withdrawn by the instructor.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 college-wide graduation requirements in addition to the Mathematics major:

- 124 total hours
- 30 upper division hours
- WCore requirements

## Mathematics Major

Requirement Description	Credit Hours	Prerequisites
<b>I. World Language Requirement</b>	<b>8</b>	
Mathematics majors must complete eight credit hours in a single world language.		
<b>II. Lower Division Courses</b>	<b>24</b>	
DATA 220 Introduction to Statistics (4)		
MATH 201 Calculus I (4) ( <i>if needed</i> )		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)		
<b>III. Upper Division Courses</b>	<b>10</b>	
MATH 312 Abstract Algebra (4)		MATH 210
MATH 321 Advanced Calculus (4)		MATH 201, 210
MATH 485 Senior Seminar (2) <b>OR</b> WCSAM 400 Science Capstone (2) ( <i>by advisor approval</i> )		Senior standing or consent of instructor
<b>IV. Electives</b>	<b>15</b>	
Additional upper-division coursework in MATH or DATA (15). Students may apply at most six credits of May term hours toward the upper division elective requirement.		
<b>V. Required Courses from Other Programs</b>	<b>8-10</b>	

PHYS 211 Physics for Scientists and Engineers I and Lab (4)  
(or 4 or 5 on the AP Physics Exam)

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 190 Learning to Code (Python) (2)  
AND DATA 360 Data Science with Python (4)
- CMPT 190 Learning to Code (Python) (2)  
AND BIOL/CHEM/PHYS 370 Scientific Computing (4)

CMPT 201 OR CMPT 210  
(CMPT 190 OR CMPT 202)  
AND DATA 220  
PHYS 211 OR MATH 201 AND  
PHYS 151

\*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.

<b>TOTAL HOURS FOR MATHEMATICS MAJOR</b>	<b>65-67</b>
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**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 college-wide requirements for graduation.

	Fall Semester	Spring Semester
Freshman Year	MATH 201 (if needed) CMPT 201	MATH 202 MATH 210
Sophomore Year	MATH 203 DATA 220	WCSAM 203 MATH elective (upper division)
Junior Year	MATH elective (upper division) PHYS 211	MATH 312 MATH elective (upper division)
Senior Year	MATH 321 MATH elective (upper division)	MATH 485 <i>or</i> WCSAM 400

**Mathematics Minor**

Requirement Description	Credit Hours	Prerequisites
<b>I. Required Courses</b>	<b>20</b>	
DATA 220 Introduction to Statistics (4)		
MATH 201 Calculus I (4) ( <i>if needed</i> )		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)		
<b>II. Elective Courses</b>	<b>7</b>	
Chosen from MATH 203 Multivariate Calculus, and upper-division coursework in MATH or DATA (7)		
<b>TOTAL HOURS FOR MATHEMATICS MINOR</b>	<b>27</b>	

## 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 college policy that disallows double-counting of elective courses.

Requirement Description	Credit Hours	Prerequisites
<b>I. Required Courses</b>	<b>12</b>	
DATA 220 Introduction to Statistics (4)		
MATH 201 Calculus I (4)		MATH 144 or placement test
WCSAM 203 Linear Algebra (4)		
<b>II. Upper Division Courses</b>	<b>4</b>	
<i>Take <b>one</b> of the following courses, from any of the groups:</i>		
<b>Computation</b>		
BIOL/CHEM/PHYS 370 Scientific Computing (4)		PHYS 211, or both PHYS 151 and MATH 201
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
<b>Economics/Finance</b>		
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
<b>Science</b>		
MATH 363 Differential Equations (4)		MATH 202
PHYS 309 Mathematical Methods of Physics (4)		MATH 202, PHYS 211
<b>Statistics</b>		
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
<b>III. Electives</b>	<b>10</b>	
MATH 202 Calculus II (4)		MATH 201 or placement test
MATH 203 Multivariate Calculus (4)		MATH 202
MATH 210 Discrete Mathematics (4)		
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
MATH 300 Special Topics in Mathematics designated as applied math topics		instructor permission
Other MATH course work as approved by the program chair.		
DATA 350 Statistical Modeling (4)		DATA 220
DATA 370 Statistical Learning (4)		DATA 350
<b>TOTAL HOURS FOR APPLIED MINOR</b>	<b>26</b>	

## Elementary Teaching Minor (Level II)

Requirement Description	Credit Hours	Prerequisites
<b>I. Required Courses</b>	<b>23</b>	
EDUC 387 Methods of Teaching Secondary School Math (3)		
MATH 144 Functions Modeling Change (4) <i>(if needed)</i>		MATH 101 or placement test
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
Take <b>one</b> course from the following group:		
• DATA 150 Data and Society (4) <b>or</b>		
DATA 220 Introduction to Statistics (4)		
<b>TOTAL HOURS FOR ELEMENTARY TEACHING MINOR</b>	<b>23</b>	

## 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)