MATHEMATICS, BS

Mathematics is the international language of science and technology. Much of the subject matter in engineering and the natural sciences, as well as some social sciences such as economics, is presented in mathematical terms. Mathematical and statistical techniques are vital in fields that usually are not considered mathematical, such as biology, psychology, and political science.

Some students come to mathematical sciences with the intention of teaching in high school or college or pursuing research in mathematics. Some are attracted to mathematics for its own sake, for the beauty, discipline, logic, and problem-solving challenges. Other students pursue mathematics in order to achieve deeper understanding in their own areas of study.

Many students assume that most math majors become teachers. While many do, there are many other opportunities for math majors. The United States National Security Agency is the largest employer of math majors in the country. Math majors will also be found at NASA; in engineering firms; at insurance and risk management firms; in robotics and computer science companies; at large and small corporations working in market research, data management and web management; at social media start ups and established firms like YouTube; and any place that needs to make decisions based on numerical facts.

At UWM, the Math major has been designed to be flexible so that students could complete their major requirements via courses that match their interests and goals. Many students should find it relatively easy to complete double majors in mathematics and another subject.

Most mathematics courses belong in one of the following four groups: applied mathematics, computational mathematics, pure mathematics, and statistics.

- Applied Mathematics is a discipline using mathematical analysis to solve problems coming from outside the field of mathematics.
- Computational mathematics is closely related to applied mathematics. It emphasizes techniques of scientific computing and other computational analysis.
- Pure mathematics emphasizes the theory and structure underlying all areas of mathematics.
- Statistics is a field of mathematics that provides strategies and tools for using data to gain insight into real-world and experimental problems.

Students of the sciences, engineering, computer science, economics, and business often complete a significant number of mathematical sciences credits. These students are encouraged to take a mathematics major or minor, which adds an official recognition of important analytical skills valued by employers and graduate schools.

Students interested in teaching mathematics at the K-12 level should examine the School of Education (http://catalog.uwm.edu/education) programs.

Some students with an interest in computer science, choose to enroll in the Applied Math and Computer Science (http://catalog.uwm.edu/letters-science/mathematical-sciences/applied-math-computer-science-bs) program. This program is ideal for the student who might have considered double majoring in both math and computer science; it combines applied math courses with computer science classes for you into one program.

Requirements
Course of Study – Bachelor of Science Degree

Complete 120 credits including 90 credits in the College of Letters & Science and with 36 of the 90 credits in L&S upper-level (numbered above 300) courses and 30 of those 36 credits in designated upper-level Natural Science. The College requires that students must complete in residence at UWM at least 15 credits in upper-division (numbered 300 or above) courses in their major. Students are also required to complete University-wide General Education Requirements and the specific L&S requirements listed below.

To complete a major, students must satisfy all the requirements of the major as stated in this catalog. Students who declare their majors within five years of entering the UW System as a degree candidate may satisfy the requirements outlined in any catalog issued since the time they entered. Credits used to satisfy the major also may be used to satisfy other degree requirements.

University General Education Requirements (GER)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH 102</td>
<td>College Writing and Research (or equivalent)</td>
<td></td>
</tr>
<tr>
<td>MATH 103</td>
<td>Contemporary Applications of Mathematics</td>
<td></td>
</tr>
<tr>
<td>MATH 105</td>
<td>Introduction to College Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 108</td>
<td>Algebraic Literacy II</td>
<td></td>
</tr>
<tr>
<td>MATH 111</td>
<td>Introduction to Logic - Critical Reasoning</td>
<td></td>
</tr>
<tr>
<td>or PHILOS 111</td>
<td>Introduction to Logic - Critical Reasoning</td>
<td></td>
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</tbody>
</table>

Select one of the following:

<table>
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<tr>
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<th>Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH 102</td>
<td>College Writing and Research (or equivalent)</td>
<td></td>
</tr>
</tbody>
</table>

Part B

Course designated as QL-B; may be completed through a major-specific course requirement

Arts

Select 3 credits  

Humanities

Select 6 credits

Social Sciences

Select 6 credits

Natural Sciences

Select 6 credits (At least two courses including one lab)

UWM Foreign Language Requirement

Complete Foreign Language Requirement through:
Two years (high school) of a single foreign language  
Two semesters (college) of a single foreign language  
Or equivalent

UWM Cultural Diversity Requirement  
One course from the Arts, Humanities, or Social Sciences must also satisfy UWM’s Cultural Diversity requirement

1 Math 111 and Philosophy 111 are jointly offered and count as repeats of one another. Students cannot receive credit for both courses.

College of Letters & Science Requirements  
I. English Writing Requirement  
Students must satisfy the English Writing Requirement by completing ENGLISH 102 with a grade of C or higher or by placing beyond English 102 on the English Placement Test (EPT).

Note: This requirement is the same as the University General Education Requirement for Oral and Written Communication Part A. The College of Letters & Science does not have a specific requirement for a writing course beyond English 102, but students must complete the university-wide requirement for Oral and Written Communication Part B listed above.

II. Mathematics and Formal Reasoning  
To satisfy the Mathematics and Formal Reasoning Requirement, Bachelors of Sciences degree students must satisfy the following two requirements:

1. Complete one of the following courses or an equivalent course:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 211</td>
<td>Survey in Calculus and Analytic Geometry</td>
<td>4</td>
</tr>
<tr>
<td>MATH 213</td>
<td>Calculus with Life Sciences Applications</td>
<td>4</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Honors Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus and Analytic Geometry I</td>
<td>4</td>
</tr>
</tbody>
</table>

2. Complete one course (at least 3 credits) at the 200 level or above chosen from courses in Mathematics, PHILOS 212, or Letters and Science statistics courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRIC 220</td>
<td>Introduction to Statistics in African and African Diaspora Studies</td>
<td></td>
</tr>
<tr>
<td>ANTHRO 568</td>
<td>Introduction to Anthropological Statistics</td>
<td></td>
</tr>
<tr>
<td>ATM SCI 500</td>
<td>Statistical Methods in Atmospheric Sciences</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 465</td>
<td>Biostatistics</td>
<td></td>
</tr>
<tr>
<td>ECON 210</td>
<td>Economic Statistics</td>
<td></td>
</tr>
<tr>
<td>GEOG 247</td>
<td>Quantitative Analysis in Geography</td>
<td></td>
</tr>
<tr>
<td>HIST 595</td>
<td>The Quantitative Analysis of Historical Data</td>
<td></td>
</tr>
<tr>
<td>MTHSTAT 215</td>
<td>Elementary Statistical Analysis</td>
<td></td>
</tr>
<tr>
<td>PHILOS 211</td>
<td>Elementary Logic</td>
<td></td>
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</tbody>
</table>

III. Foreign Language Requirement  
Two courses (minimum of 6 credits) in a language (including American Sign Language) other than English at the 100 level or above are required. Placement testing may be used to satisfy all or part of this requirement. Language courses (including American Sign Language) other than English taken in high school may be used to satisfy all or part of this requirement. One year of high school language equates to one semester of college work.

Completion of the L&S Language Requirement also satisfies the university-wide Foreign Language GER, but not vice versa.

IV. International Requirement  
See Approved Courses for the L&S International Requirement (http://catalog.uwm.edu/letters-science/approved-courses-international-requirement) for course options.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>POL SCI 390</td>
<td>Political Data Analysis</td>
<td></td>
</tr>
<tr>
<td>POL SCI 392</td>
<td>Survey Research</td>
<td></td>
</tr>
<tr>
<td>PSYCH 210</td>
<td>Psychological Statistics</td>
<td></td>
</tr>
<tr>
<td>SOCIOL 261</td>
<td>Introduction to Statistical Thinking in Sociology</td>
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</tbody>
</table>

Note: This requirement is NOT the same as the University General Education Requirement for Quantitative Literacy Part B. To complete the BS, students must take one of the L&S approved courses. The courses listed here will satisfy the QL-B requirement.

V. Breadth Requirement  
Along with completing the University General Education Requirements of 3 credits in the Arts (A); 6 credits in the Humanities (HU), Social Sciences (SS), and Natural Sciences (NS/NS+); and a course with the Cultural Diversity (CD/+ designation, L&S students must complete the Breadth requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td>Select 3 credits</td>
<td>3</td>
</tr>
<tr>
<td>Humanities</td>
<td>Complete 12 credits of L&amp;S courses with Humanities Breadth designation; no more than 6 credits from a single subject area.</td>
<td>12</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>Complete 12 credits of L&amp;S Courses with Social Science Breadth designation; no more than 6 credits from a single curricular area.</td>
<td>12</td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>Complete 12 credits of L&amp;S Courses with Natural Sciences Breadth designation, including laboratory or field courses from three different curricular areas.</td>
<td>12</td>
</tr>
</tbody>
</table>

Cultural Diversity
The following courses are required for the Mathematics major:

- Students should check their course selections carefully with the list of approved L&S Breadth Courses (http://catalog.uwm.edu/letters-science/breadth-requirement-course-list). Students are advised to select at least 6 credits worth of courses in each of the Humanities, Social Science, and Natural Sciences areas that can satisfy both the campus-wide General Education Requirements and the L&S Breadth requirement.

- Students are advised to select a course that satisfies the Cultural Diversity requirement as well as a Humanities or Social Science breadth/GER requirement.

** VI. The Major **
The College requires that students attain at least a 2.0 GPA in all credits in the major attempted at UWM. In addition, students must attain a 2.0 GPA on all major credits attempted, including any transfer work. Individual departments or programs may require higher GPAs for graduation. Some departmental majors require courses from other departments. Contact your major department for information on whether those credits will count as part of the major GPA. The College requires that students must complete in residence at UWM at least 15 credits in upper-division (numbered 300 or above) courses in their major.

** Research Requirement **
Within their majors, students must complete a research experience approved by the L&S faculty. A list of courses satisfying the research requirement in each major can be found here (http://catalog.uwm.edu/letters-science/approved-courses-research-requirement).

** VII. The Minor **
The College requires that students attain at least a 2.0 GPA in all credits in the minor attempted at UWM. In addition, students must attain a 2.0 GPA on all minor credits attempted, including any transfer work. Individual departments or programs may require higher GPAs for graduation.

** Mathematics Major Requirements **

** Preparatory Curriculum **
Students in all majors in the Department of Mathematical Sciences must complete MATH 231 (or MATH 213), MATH 232, and MATH 233 (or equivalent). MATH 221 and MATH 222 are equivalent to MATH 231, MATH 232, and MATH 233. Students majoring in mathematics must have a GPA of at least 2.500 in these courses. All majors must take either MATH 234 or MATH 240, as well as a course in computer programming in a modern, high-level language (e.g., COMPSCI 151, COMPSCI 250, or COMPSCI 251). The department also recommends strongly one year of calculus-based physics.

** Capstone Experience **
Students in all majors and major options in the Department of Mathematical Sciences must complete a “Capstone Experience.” The aim of the department’s capstone experience is to encourage independent learning. Students complete a research paper in the context of this course, which satisfies the L&S research requirement. Mathematics majors may choose either MATH 599 or MATH 575. Students must obtain consent of a professor to enroll in MATH 599.

** Requirements **
The following courses are required for the Mathematics major:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 341</td>
<td>Seminar: Introduction to the Language and Practice of Mathematics</td>
<td>3</td>
</tr>
</tbody>
</table>

Select 24 credits in upper-division math courses (those numbered 300 and above, and in curricular areas MATH or MTHSTAT). Required among these 24 upper-division math credits are at least six credits in math courses numbered 500 and above, excluding MATH 591, MATH 599, MATH 699 or MTHSTAT 591.

Total Credits 27

** Additional Requirements **
- Note that MATH 381 and MTHSTAT 465 and MTHSTAT 467 are not open for credit in the Mathematics major.
- Students must complete at least 15 upper-division (numbered 300 and above) credits in the major in residence at UWM.
- The College requires that students attain at least a 2.0 GPA on all credits in the major attempted at UWM. In addition, students must attain a 2.0 GPA on all major credits attempted, including transfer work.

** Recommendations **
Mathematics courses fall naturally into the following groups (see below for individual courses):

1. Applied Mathematics
2. Computational Mathematics
3. Probability and Statistics
4. Pure Mathematics

For students planning to pursue graduate studies in mathematics, we recommend students take at least 36 cr upper division mathematics courses, with as many courses as possible from Pure Mathematics, Group 1. Many PhD programs require reading knowledge of French, German, or Russian.

For students planning to pursue graduate studies in statistics or economics, we recommend MATH 521, MATH 522, and as many as possible of MTHSTAT 361, MTHSTAT 362, and MTHSTAT 562-MTHSTAT 568.

For students seeking employment in statistics after the bachelor’s degree, we recommend MTHSTAT 361, MTHSTAT 362, and as many as possible of MTHSTAT 562-MTHSTAT 568, as well as courses in computer programming (COMPSCI 250, COMPSCI 251, etc.).

For students seeking general non-academic employment after the bachelor’s degree, we recommend courses from the Probability and Statistics group (including MTHSTAT 362), the Applied Mathematics group (including both modeling and differential equations), the Computational Mathematics group, Linear Algebra (MATH 535), and courses in computer programming (COMPSCI 240, COMPSCI 250, COMPSCI 251, etc.).

For students intending to become high school mathematics teachers, we recommend courses in algebra (MATH 431, MATH 531), geometry (MATH 451, MATH 453), linear algebra (MATH 535), numerical methods (MATH 413), advanced calculus (MATH 521, MATH 522), the math education capstone (MATH 575), and probability and statistics (MTHSTAT 361 & MTHSTAT 362).

For students pursuing a major in mathematics as a liberal art, for general logical and critical thinking skills, we recommend the Pure Mathematics courses.
### Mathematics Advising

Students considering a major in the Department of Mathematical Sciences need to come to the department to declare their major and be assigned a faculty advisor. All courses selected for the major must be approved by the advisor, and students should check regularly with their advisors to plan their courses of study in a coherent and timely fashion.

### Letters & Science Advising

The College of Letters and Science provides general academic advising for all students with a major in the College, particularly as it relates to campus’ general education requirements and the College’s degree requirements. We also provide specialized advising for pre-professional students (pre-med, pre-dental, pre-pharmacy, etc.) regardless if their major is in Letters and Science or not. Prospective students, including high school students and students seeking to transfer to a program in Letters and Science may also receive advising from our admissions counselors.

Upon admission, students are assigned an advisor in the College advising office. Academic advising is available Monday through Friday from 8:30 a.m. to 4:30 p.m. by appointment. Appointments outside of these times may be available and phone appointments are available for online students. The advising office (https://uwm.edu/letters-science/advising/contact-advising) is located on the first floor of Holton Hall. Current students should call (414) 229-4654 to schedule an appointment or use the Student Success Collaborative website (https://uwmilwaukee.campus.eab.com) to make an appointment with your assigned advisor; online scheduling is only available if you already have a Letters & Science advisor assigned to you. Prospective students should call (414) 229-7711 or email let-sci@uwm.edu.

When students declare a major, they will receive an additional faculty advisor located within the major department who will assist with requirements for that major. Students should read the “Declaration of Major” information on the website of the major that they are interested in. In some cases, the student will need to choose a faculty advisor as part of the declaration process.

All students are cautioned to consult their Letters & Science academic advisor AND their major advisor prior to each registration period to ensure they understand all requirements. Do not rely on pre-printed sample plans, as they are intended to be samples only and may not be right for your particular situation.

### Honors in the Major

Students in Mathematics who meet all of the following criteria can be awarded honors in the major upon graduation:

1. A 3.000 cumulative GPA in all UWM graded credits;
2. A 3.500 GPA over all UWM courses counting toward the Mathematics major;
3. A 3.500 GPA over all upper-division UWM courses counting toward the Mathematics major; and
4. At least one of the following:
   • Successful completion of at least two semesters of research and/or internship experiences. These may include one or more of the Capstone Experience (MATH 599), a directed independent study for credit (MATH 699), an internship for credit (MATH 489), and undergraduate research for compensation.
   • Successful completion of at least 6 credits in Mathematical Sciences (curricular areas Math or MthStat) courses numbered 600 or above.
   • A score of at least the 50th percentile on the Math Subject GRE.

Students who believe they may qualify for honors in Mathematics should apply to the Mathematical Sciences Department during their last semester of study.

Honors in the College of Letters and Science

Dean's Honor List
GPA of 3.750 or above, earned on a full-time student's GPA on 12 or more graded credits in a given semester.

Honors Degree and Honors Degree with Thesis
Granted to graduating seniors who complete Honors College requirements, as listed in the Honors College (http://catalog.uwm.edu/opportunities-resources/honors-college) section of this site.

Commencement Honors
Students with a cumulative GPA of 3.500 or above, based on a minimum of 40 graded UWM credits earned prior to the final semester, will receive all-university commencement honors and be awarded the traditional gold cord at the December or May Honors Convocation. In schools and colleges in which fewer than 15% of the traditional students have a 3.500 GPA, all-university honors will be awarded to approximately the top 15% of graduating students. A criterion GPA (not lower than 3.200) for this 15% will be calculated based on statistics from the previous comparable semester. Please note that for honors calculation, the GPA is not rounded and is truncated at the third decimal (e.g., 3.499).

Final Honors
Earned on a minimum of 60 graded UWM credits: Cum Laude - 3.500 or above; Magna Cum Laude - 3.650 or above; Summa Cum Laude - 3.800 or above.

Contact Information
Current Students contact the Department directly, math-staff@uwm.edu
Prospective Students contact a Letters & Science Admissions Counselor at (414) 229-7711 or let-sci@uwm.edu
http://uwm.edu/math/undergraduate/