

Mathematics and Economics Major

Program Requirements

• **Total units required: 57**

Required Courses

Code	Title	Units
CSE 131	Introduction to Computer Science	3
Econ 1011	Introduction to Microeconomics	3
Econ 1021	Introduction to Macroeconomics	3
Econ 4011	Intermediate Microeconomic Theory	3
Econ 4021	Intermediate Macroeconomic Theory	3
Econ 413	Introduction to Econometrics	3
or Econ 413W	Introduction to Econometrics with Writing	
Math 131	Calculus I	3
Math 132	Calculus II	3
Math 233	Calculus III	3
Math 309	Matrix Algebra	3
Math 310	Foundations for Higher Mathematics	3
or Math 310W	Foundations For Higher Mathematics With Writing	
SDS 3200	Elementary to Intermediate Statistics and Data Analysis	3
or SDS 3211	Statistics for Data Science I	
or Math 493C	Probability	
Total Units		36

Elective Courses

Majors must complete seven electives drawn from the lists below. Three electives must be drawn from the Economics list and three electives must be drawn from the Mathematics list. The remaining elective may come from either department or from the preapproved elective list below.

Economics

One of the three Economics electives can be any Economics course with Econ 4011 or Econ 4021 as a prerequisite, including from an approved study abroad program. The other two economics electives must come from the following list:

Code	Title	Units
Econ 404	Behavioral Economics and Experimental Economics	3
Econ 407	Market Design	3
Econ 410	Macroeconomics of Inequality	3
Econ 4111	Optimization and Economic Theory	3

Econ 4151	Applied Econometrics	3
Econ 4160	Topics in Econometrics: Microeconometrics	3
Econ 4210	Topics in Financial Economics: Asset Pricing	3
Econ 4211	Topics in Financial Economics: Investments	3
Econ 435	Open Economy Macroeconomics	3
Econ 437	The Economics of Financial Intermediation	3
Econ 445	Public Finance	3
Econ 452	Industrial Organization	3
Econ 4567	Auction Theory and Practice	3
Econ 460	Urban Economics	3
Econ 467	Game Theory	3
Econ 471	Development Economics	3
Econ 480	Labor Economics	3
Econ 484	Computational Macroeconomics	3

Mathematics

The three Mathematics electives must come from the following list:

Code	Title	Units
Math 312	Differential Equations and Dynamical Systems	3
Math 318	Introduction to Calculus of Several Variables	3
Math 371	Graph Theory	3
Math 410	Introduction to Fourier Series and Integrals	3
Math 4111	Introduction to Analysis	3
Math 4121	Introduction to Lebesgue Integration	3
Math 415	Partial Differential Equations	3
Math 416	Complex Variables	3
Math 429	Linear Algebra	3
Math 449	Numerical Applied Mathematics	3
Math 450	Topics in Applied Mathematics	3
Math 456	Topics in Financial Mathematics	3
Math 493C	Probability	3
Math 495C	Stochastic Processes	3

* Students choosing both Math 312 and Math 318 must complete four L24 Mathematics electives from the list above. Math 493C can be taken for elective credit in the major if SDS 3200 (or SDS 3211) is completed to satisfy the core requirements.

Preapproved Electives

One elective in the major can come from the following list:

Code	Title	Units
SDS 420	Experimental Design	3
SDS 439	Linear Statistical Models	3
SDS 4392	Advanced Linear Statistical Models	3
SDS 459	Bayesian Statistics	3
SDS 460	Multivariate Statistical Analysis	3
SDS 461	Time Series Analysis	3
SDS 462	Mathematical Foundations of Big Data	3
SDS 475	Statistical Computation	3
SDS 494	Mathematical Statistics	3

Additional Information

- Students may declare a prime or a second major in Mathematics and Economics via L24 (Math) or L11 (Econ), and that will determine their major advisor.
- Students cannot declare more than one major or minor in the Department of Economics. This restriction includes dual majors, such as Mathematics and Economics (and Economics and Computer Science). Dual majors are considered "in the department" even if they are declared in another department.
- All courses in the major must be completed with the letter grade option, and a grade of at least C- must be earned in each.
- It is possible to earn the Financial Economics Specialization in conjunction with this major (prime or second).
- It is recommended that students completing Math 203 and Math 204 should bypass Math 309 and Math 310. However, they must complete one upper-level Mathematics elective from the list above (with the exception of Math 318) in lieu of Math 309 and Math 310.
- With instructor permission, students may use any of the following for Economics elective credit: Econ 501, Econ 502, Econ 503, Econ 504, Econ 511, or Econ 513.
- Transfer credit, including study abroad approval, for mathematics courses, for probability/statistics courses, or for CSE 131 is approved by the respective departments and is accepted by the Department of Economics for major credit.
- Majors may receive a maximum of 6 units of transfer credit from other colleges/universities to replace Econ 1011 and Econ 1021 (3 units of transfer credit per course). A minimum grade of C- must be earned. Preapproval by the Academic Coordinator (dottie@wustl.edu) in the Department of Economics is required.
- Majors selecting an approved study abroad program (for one semester) may receive transfer credit for Econ 413. **Note:** Many study abroad programs in Europe do not offer the equivalent of Econ 413 in the spring semester. A grade of C (or higher) is required in study abroad course work. Preapproval from the Department of Economics' study abroad advisor is required.

- Majors selecting an approved study abroad program (for one semester) may also receive transfer credit for up to two economics electives. (Majors completing two economics electives abroad are required to complete four economics electives in the major.) A grade of C (or higher) is required in study abroad course work. Preapproval from the department's study abroad advisor is required.
- Majors selecting an approved study abroad program for a full year of study will be handled on a case-by-case basis in terms of meeting degree requirements.
- AP credit for Econ 1011, Econ 1021, Math 131, and/or Math 132 is accepted in the major. Consult with the Department of Mathematics and the Department of Economics for International Baccalaureate and British A-level policies.
- For further details on policies and procedures, please refer to the Undergraduate Guide and the Department of Economics' website, or schedule a meeting with the department's Academic Coordinator (dottie@wustl.edu).

Additional Requirements

1. A student cannot declare more than one major or minor in the Department of Mathematics. This restriction includes dual majors, such as Mathematics and Economics and Mathematics and Computer Science. These majors are considered "in the department" even if they are declared in another department.
2. No upper-level course used to satisfy a major requirement can be counted toward the requirements of any other major or minor (i.e., no double-counting of courses).
3. Courses transferred from other accredited colleges and universities can be counted, with the following caveats, if they receive department approval:
 - a. Courses transferred from a two-year college (e.g., a community college) cannot be used to satisfy upper-level requirements.
 - b. At least half of the upper-level units required in a major must be earned at Washington University or in a Washington University-approved overseas study program.
 - c. Courses from the School of Continuing & Professional Studies cannot be used to fulfill major requirements.

Latin Honors

At the time of graduation, the Department of Mathematics will recommend that a candidate receive Latin Honors (cum laude, magna cum laude, or summa cum laude) if that student has completed the department's requirements for High Distinction or Highest Distinction in Mathematics, including an Honors Thesis. The actual award of Latin Honors is managed by the College of Arts & Sciences.

The Honors Thesis

Arts & Sciences mathematics majors who want to be candidates for Latin Honors, High Distinction, or Highest Distinction must complete an honors thesis. Writing an honors thesis involves a considerable amount of independent work, reading, creating mathematics, writing a paper that meets acceptable professional standards, and making an oral presentation of the results.

Types of Projects

An honors thesis can take two forms:

1. A thesis that presents significant work by the student on one or more nontrivial mathematics problems.
2. A substantial expository paper that follows independent study on an advanced topic under the guidance of a department faculty member. Such a report would involve the careful presentation of ideas and the synthesis of materials from several sources.

Process and Suggested Timeline

Junior Year, Spring Semester:

1. Talk with a faculty advisor about possible projects.
2. Complete the Honors Proposal Form and submit it to Blake Thornton.

Senior Year:

1. By the end of January, provide the advisor with a draft abstract and outline of the paper.
2. By the end of February, submit a rough draft, including an abstract, to the advisor.
3. The student and the advisor should agree on a date that the writing will be complete and on a date and time for the oral presentation in mid-March (the deadline is March 31).

Departmental Prizes

Each year, the department considers graduating majors for three departmental prizes and also awards a prize to juniors. Recipients are recognized at an annual awards ceremony in April where graduating majors each receive a certificate and a set of honors cords to be worn as part of the academic dress at Commencement. Awards are noted on the student's permanent university record.

Ross Middlemiss Prize

The Ross Middlemiss Prize is awarded to a graduating math major with an outstanding record. The award was established by former Professor Ross Middlemiss, who taught at Washington University for 40 years. Middlemiss authored several books, including a widely popular calculus text that was used in courses offered by the School of Continuing & Professional Studies until the late 1970s.

Putnam Exam Prize

The Putnam Exam Prize is awarded to a graduating senior who has participated regularly in the Putnam Exam Competition and done exceptionally well throughout their time at Washington University.

Martin Silverstein Award

The Martin Silverstein Award was established in memory of Professor Martin Silverstein, who, until his death in 2004, was a pioneer in work at the interface of probability theory and harmonic analysis. Graduating students completing any major we offer will be considered for this award, but preference is given to those who have done excellent work in applied mathematics or analysis.

Brian Blank Award

The Brian Blank Award was established in memory of Professor Brian Blank, who passed away in 2018. Each year, the Department of Mathematics selects distinguished juniors majoring in mathematics for this prize.

Distinctions in Mathematics and Economics

Distinction

- Complete one additional course in Economics and one additional course in Mathematics, for a total of nine electives. Both courses must be completed at the 400 level or above with a grade of B or better. (In Economics, "400-level" should be interpreted as a course having an Econ 4011 and/or Econ 4021 prerequisite.)
- Maintain a GPA of 3.7 or higher in all the major courses.
- If the student takes additional courses that satisfy these requirements, then the courses with the lowest grades may be omitted when calculating the GPA for this purpose.

High Distinction

- Complete all requirements for Distinction.
- Complete an honors thesis in either department (Mathematics or Economics).

Highest Distinction

- Complete all requirements for High Distinction.
- Complete three additional courses in Economics or Mathematics for a total of 12 electives. At least one of the three additional courses must be taken in each department, and all three additional electives must be completed at the 400 level or above. (In Economics, "400 level" should be interpreted as a course having an Econ 4011 and/or Econ 4021 prerequisite.)
- All 12 electives (including the seven electives for the major, the two electives for Distinction, and the three electives for Highest Distinction) must be completed with a grade of B+ or better.
- If the student takes additional courses that satisfy these requirements, then the courses with the lowest grades may be omitted when calculating the GPA for this purpose.

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