

The **Mathematical Sciences Program** is designed to provide broad training in basic mathematics together with some specialization in an area of application of mathematics. Each student must select one of the eight Program Options as a special area. Because the program options have somewhat more specific requirements, careful planning and frequent consultation with your advisor are essential to ensure timely completion of the program. The concentration program must include at least nine courses: four basic courses (II.), three courses from one of the Program Options (III.), and two additional courses (IV.) as described below. At least two of the five (optional and additional) courses must be MATH courses.

### I. **Prerequisites\*\* (3 courses)** {must be completed with C- or better}

| Instructions                                                                                | Course(s)                                                                            | Student Elections<br>(enter your course selections here) |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------|
| Select <b>one</b> of the following <b>course pairs</b> :                                    | Math 215 & 217<br>Math 285 & 217<br>Math 205 & 217<br>Math 295 & 296                 | 1. _____<br>2. _____                                     |
| <b>EECS 183 or working knowledge</b> of a high-level computer language (Fortran, C, or C++) | EECS 183 or working knowledge of a high-level computer language (Fortran, C, or C++) | 3. _____                                                 |

### II. **Basic Courses\*\* (4 courses)** {must be completed with C- or better}

| Instructions                                                                                                                                                      | Course(s)                                                | Student Elections<br>(enter your course selections here) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| Select <b>one</b> of the following <b>Differential Equations</b> courses:                                                                                         | Math 316    Math 286                                     | 1. _____                                                 |
| Select <b>one</b> of the following <b>Discrete Math/Modern Algebra</b> courses:                                                                                   | Math 312    Math 465<br>Math 412    Math 493             | 2. _____                                                 |
| Select <b>one</b> of the following <b>Analysis</b> courses: ( <i>Students in Mathematical Economics should choose Math 351 or 451 as their Analysis course.</i> ) | Math 351    Math 354<br>Math 451    Math 450<br>Math 454 | 3. _____                                                 |
| Select <b>one</b> of the following <b>Probability</b> courses:                                                                                                    | Math 425    Math 525                                     | 4. _____                                                 |

**\*\* Advanced students, such as those who have completed Math 396, may substitute higher-level courses with the approval of a concentration advisor. All students are strongly encouraged to include in their program one of the more theoretical courses: Math 412, 451, 493, or 525.**

### III. Program Options: Mathematical Economics (3 courses)

One definition of economics is the study of the optimal allocation of scarce resources. Several mathematical techniques are fundamental to this study: constrained optimization using Lagrange multipliers, n-dimensional calculus especially the Implicit Function Theorem (dependence of a solution on parameters), dynamics, probability and statistics to deal with inherent uncertainty, game theory to deal with decisions in which the actions of one agent affect the options of others, and proofs for understanding the derivation of economic principles. To ensure coverage of these topics, students choosing the Mathematical Economics option will usually choose Math 423, Stat 426, Econ 452, as courses from the options list; and Econ 401 together with a mathematics course at the 400-level or above as their related courses. A student who completes this option should find opportunities in business, government, and research organizations which collect, analyze, and model data having economic, social, and political parameters. **Many students in this program pursue a second major in Economics;** this combination is a powerful recommendation to a prospective employer that the student can think quantitatively, understand complex reasoning, and work with economic models.

| Instructions                                  | Course(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Student Elections<br>(enter your course selections here) |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Select <b>three</b> of the following courses: | <div> Math 420 - Adv. Linear Algebra<br/> Math 423 - Math of Finance<br/> Math 424 - Compound Interest &amp; Life Ins<br/> Math 452 - Intro Analys: Multi<br/> Math 462 - Math Models<br/> Math 471 - Intro Num Methods<br/> Math 472 - Num Meth w/FinAp<br/> Math 474 - Intro Stochastic Analysis for Fin </div> <div> Math 523 - Loss Models I<br/> Math 561 - Linear Program I<br/> Math 562 - Cont. Optimiz Meth<br/> Math 623 - Comput. Finance<br/> ECON 401 - Interm Microecon Thry<br/> ECON 407 - Behavioral Econ<br/> ECON 409 - Game Theory<br/> ECON 452 - Intmd Economet II<br/> STATS 426 - Intro to Thry Stats </div> | 1. _____<br>2. _____<br>3. _____                         |

### IV. Advanced Courses (2 courses)

To complete the major program, each student should elect two additional advanced courses in mathematics or a related area. In all cases, **approval from a departmental advisor is required**. This is a very flexible requirement designed to accommodate special interests and may be satisfied by a broad range of courses in other departments (generally numbered 300 or above) or by mathematics courses numbered 400 or above.

| Instructions                        | Course(s)                                                          | Student Elections<br>(enter your course selections here) |
|-------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------|
| Select <b>two Advanced</b> courses: | <i>Selected with approval from a mathematical sciences advisor</i> | 1. _____<br>2. _____                                     |

### V. Requirements

At least two of the courses in III. and IV. must be MATH courses.

At least one must be a cognate course numbered 300 or above taught outside the department that emphasizes

University of Michigan Math Department | 2082 East Hall | 530 Church Street | Ann Arbor, MI | 734.763.4223

Undergraduate Student Services: [math-undergrad-office@umich.edu](mailto:math-undergrad-office@umich.edu)

Graduate Student Services: [math-grad-office@umich.edu](mailto:math-grad-office@umich.edu)

[lsa.umich.edu/math](http://lsa.umich.edu/math)

---

applying significant mathematical tools (at least at the level of Math 215) in another discipline.