

# Department of Mathematics

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## The Faculty

**Chair:** Warren B. Gordon

## Professors:

- Arthur Apter (*University Distinguished Professor*)
- Jim Gatheral (*Presidential Professor*)
- Warren B. Gordon
- Miriam Hausman
- Bruce Jordan
- Laurence Kirby
- Elena Kosygina
- Andrew Lesniewski
- Anita Mayo
- Carlos Julio Moreno
- Alvany Rocha
- Aaron Todd
- Tai-Ho Wang

## Associate Professors:

- C. Douglas Howard
- Rados Radoicic
- Jakob Reich
- Beryl I. Shaw
- Dan Stefanica
- Sherman Wong
- Ingrid-Mona Zamfirescu

## Assistant Professors:

- Louis-Pierre Arguin
- Michael J. Carlisle
- Feng Chen
- Peter Gregory
- Ivan Matic
- Anja Richter

## Lecturers:

- April Allen-Materowski
- Judith Broadwin

- Evan Fink
- Sarah Harney
- Jarrod Pickens
- Timothy Ridenour

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## Field Description

Mathematics has been described as the queen of all sciences. Understanding mathematics enables one to explain and analyze not only science and nature but almost all disciplines from archeology to zoology. Most recently, mathematics has become an indispensable tool in finance and other business related areas. To ensure that mathematics is available for students with varied backgrounds and different professional goals, the department offers courses at all levels. Advanced courses are designed to be taken by mathematics and actuarial science majors and those in related fields.

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## The Majors

- [Mathematics](#)
- [Actuarial Science](#)

## Mathematics

The major in mathematics is designed to enable the student to enter the marketplace (industrial or educational) or to pursue further studies in mathematics or allied fields at the graduate level. Interested students are urged to contact the Department of Mathematics as early as possible. The student will be assigned an advisor who will aid in formulating an appropriate course of study. Students who want to teach mathematics in the secondary schools should consult an advisor in the Center for Advisement and Orientation.

|                                                                                                               |                                         |           |
|---------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|
| <b>Required Courses</b><br>All students must take the following three courses:                                |                                         |           |
| <a href="#">MTH 3300</a>                                                                                      | Algorithms, Computers and Programming I | 3 credits |
| <a href="#">MTH 4010</a>                                                                                      | Advanced Calculus I                     | 3 credits |
| <a href="#">MTH 4100</a>                                                                                      | Linear Algebra and Matrix Methods       | 3 credits |
| Students may fulfill their calculus requirements by any one of the following three alternate calculus tracks: |                                         |           |
| <b>Track I:</b>                                                                                               |                                         |           |
| <a href="#">MTH 2610</a>                                                                                      | Calculus I                              | 4 credits |
| <a href="#">MTH 3010</a>                                                                                      | Calculus II                             | 4 credits |
| <a href="#">MTH 3020</a>                                                                                      | Intermediate Calculus                   | 4 credits |
|                                                                                                               | <i>or</i>                               |           |
| <a href="#">MTH 3050</a>                                                                                      | Multi-Variable and Vector Calculus      | 4 credits |
| <i>or</i><br><b>Track II:</b>                                                                                 |                                         |           |

|                                                                     |                                                         |           |
|---------------------------------------------------------------------|---------------------------------------------------------|-----------|
| MTH 2630                                                            | Analytic Geometry and Calculus I                        | 5 credits |
| MTH 3030                                                            | Analytic Geometry and Calculus II                       | 5 credits |
| <i>or</i><br><b>Track III:</b>                                      |                                                         |           |
| MTH 2205                                                            | Applied Calculus II                                     | 3 credits |
|                                                                     | <i>or</i>                                               |           |
| MTH 2207                                                            | Applied Calculus and Matrix Applications                | 4 credits |
| MTH 3006                                                            | Integral Calculus                                       | 4 credits |
| MTH 3030                                                            | Analytic Geometry and Calculus II                       | 5 credits |
| <b>Electives</b>                                                    |                                                         |           |
| Any four 4000-level or 5000-level courses from the following group: |                                                         |           |
| MTH 4020                                                            | Advanced Calculus II                                    | 3 credits |
| MTH 4030                                                            | Topology                                                | 3 credits |
| MTH 4110                                                            | Ordinary Differential Equations                         | 3 credits |
| MTH 4120                                                            | Introduction to Probability                             | 4 credits |
| MTH 4115                                                            | Numerical Methods for Differential Equations in Finance | 4 credits |
| MTH 4125                                                            | Introduction to Stochastic Process                      | 4 credits |
| MTH 4130                                                            | Mathematics of Statistics                               | 4 credits |
| MTH 4135                                                            | Computational Methods in Probability                    | 3 credits |
| MTH 4140                                                            | Graph Theory                                            | 3 credits |
| MTH 4145                                                            | Mathematical Modeling *                                 | 3 credits |
| MTH 4150                                                            | Combinatorics                                           | 3 credits |
| MTH 4200                                                            | Theory of Numbers                                       | 3 credits |
| MTH 4210                                                            | Elements of Modern Algebra                              | 3 credits |
| MTH 4230                                                            | History of Mathematics                                  | 3 credits |
| MTH 4240                                                            | Differential Geometry *                                 | 3 credits |
| MTH 4300                                                            | Algorithms, Computers and Programming II *              | 3 credits |
| MTH 4310                                                            | Methods of Numerical Analysis                           | 3 credits |
| MTH 4315                                                            | Introduction to Mathematical Logic                      | 3 credits |
| MTH 4320                                                            | Fundamental Algorithms                                  | 3 credits |

|                          |                                                             |           |
|--------------------------|-------------------------------------------------------------|-----------|
| <a href="#">MTH 4500</a> | Introductory Financial Mathematics                          | 4 credits |
| <a href="#">MTH 5010</a> | Advanced Calculus III *                                     | 3 credits |
| <a href="#">MTH 5020</a> | Theory of Functions of a Complex Variable*                  | 3 credits |
| <a href="#">MTH 5030</a> | Theory of Functions of Real Variables*                      | 3 credits |
| <a href="#">MTH 5100</a> | Partial Differential Equations and Boundary Value Problems* | 4 credits |
| <a href="#">MTH 5500</a> | Stochastic Calculus for Finance                             | 4 credits |

\* These courses are offered infrequently, subject to student demand.

**Mathematics of Finance Concentration:**

Students who wish to have a concentration in the Mathematics of Finance should choose the following five electives:

|                          |                                      |           |
|--------------------------|--------------------------------------|-----------|
| <a href="#">MTH 4110</a> | Ordinary Differential Equations      | 3 credits |
| <a href="#">MTH 4120</a> | Introduction to Probability          | 4 credits |
| <a href="#">MTH 4125</a> | Introduction to Stochastic Process   | 4 credits |
| <a href="#">MTH 4135</a> | Computational Methods in Probability | 3 credits |
| <a href="#">MTH 4500</a> | Introductory Financial Mathematics   | 4 credits |

In addition, students should take:

|                          |                       |           |
|--------------------------|-----------------------|-----------|
| <a href="#">ECO 1001</a> | Micro-Economics       | 3 credits |
| <a href="#">ECO 1002</a> | Macro-Economics       | 3 credits |
| <a href="#">FIN 3000</a> | Principles of Finance | 3 credits |
| <a href="#">FIN 3610</a> | Corporate Finance     | 3 credits |
| <i>or</i>                |                       |           |
| <a href="#">FIN 3710</a> | Investment Analysis   | 3 credits |

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**Actuarial Science**

The field of actuarial science applies mathematical principles and techniques to problems in the insurance industry. Progress in the field is generally based upon completion of examinations given by the Society of Actuaries. The Baruch College major is designed to prepare students to pass the first two exams of the Society of Actuaries year 2000 exam structure and to provide partial preparation for the third exam. Students interested in this highly structured program are urged to contact the Department of Mathematics as early as possible so that the department may assign an advisor to aid in formulating an appropriate course of study.

**Prerequisites**

|                                                                              |                                                         |           |
|------------------------------------------------------------------------------|---------------------------------------------------------|-----------|
| <a href="#">MTH 2610</a>                                                     | Calculus I                                              | 4 credits |
| <a href="#">MTH 3010</a>                                                     | Calculus II                                             | 4 credits |
| <i>or</i>                                                                    |                                                         |           |
| <a href="#">MTH 2205</a>                                                     | Applied Calculus II                                     | 3 credits |
| <a href="#">MTH 3006</a>                                                     | Integral Calculus                                       | 4 credits |
| <i>and</i>                                                                   |                                                         |           |
| <a href="#">ECO 1001</a>                                                     | Micro-Economics                                         | 3 credits |
| <a href="#">ECO 1002</a>                                                     | Macro-Economics                                         | 3 credits |
| <b>Required Courses</b>                                                      |                                                         |           |
| <a href="#">MTH 3020</a>                                                     | Intermediate Calculus                                   | 4 credits |
| <i>or</i>                                                                    |                                                         |           |
| <a href="#">MTH 3030</a>                                                     | Analytic Geometry and Calculus II                       | 5 credits |
| <i>or</i>                                                                    |                                                         |           |
| <a href="#">MTH 3050</a>                                                     | Multi-Variable and Vector Calculus                      | 4 credits |
| <i>and</i>                                                                   |                                                         |           |
| <a href="#">MTH 3300</a>                                                     | Algorithms, Computers, and Programming I                | 3 credits |
| <a href="#">MTH 4120</a>                                                     | Introduction to Probability                             | 4 credits |
| <a href="#">MTH 4410</a>                                                     | Theory of Interest                                      | 4 credits |
| <a href="#">MTH 4500</a>                                                     | Mathematical Finance                                    | 4 credits |
| <a href="#">FIN 3000</a>                                                     | Principles of Finance                                   | 3 credits |
| <a href="#">FIN 3610</a>                                                     | Corporate Finance                                       | 3 credits |
| <b>Electives</b>                                                             |                                                         |           |
| In addition, one course must be chosen from the following list of electives: |                                                         |           |
| <a href="#">MTH 4115</a>                                                     | Numerical Methods for Differential Equations in Finance | 4 credits |
| <a href="#">MTH 4125</a>                                                     | Introduction to Stochastic Processes                    | 4 credits |
| <a href="#">MTH 4130</a>                                                     | Mathematics of Statistics                               | 4 credits |
| <a href="#">MTH 4135</a>                                                     | Computational Methods in Probability                    | 3 credits |
| <a href="#">MTH 4420</a>                                                     | Actuarial Mathematics                                   | 4 credits |
| <a href="#">MTH 4421</a>                                                     | Actuarial Mathematics II                                | 4 credits |
| <a href="#">MTH 4451</a>                                                     | Risk Theory                                             | 4 credits |

|                                                                                                    |                                 |           |
|----------------------------------------------------------------------------------------------------|---------------------------------|-----------|
| <a href="#">MTH 5500</a>                                                                           | Stochastic Calculus for Finance | 4 credits |
| The following courses are recommended, but not required. They are not applicable toward the major. |                                 |           |
| <a href="#">ECO 3100</a> Intermediate Micro-Economics                                              |                                 |           |
| <a href="#">ECO 3200</a> Intermediate Macro-Economics                                              |                                 |           |

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### The Minor

The minor in mathematics provides students with a background in the various theories and uses of mathematics. The minor requires the completion of MTH 3006 or 3010 and any other 3- or 4-credit mathematics course numbered 3000 or higher. Students must then complete a capstone course consisting of any mathematics course at the 4000 level or higher.

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## Courses

### Courses in Mathematics (MTH)

|                          |                                             |                    |
|--------------------------|---------------------------------------------|--------------------|
| <a href="#">MTH 1030</a> | College Algebra                             | 4 hours; 2 credits |
| <a href="#">MTH 2003</a> | Pre-calculus and Elements of Calculus       | 4 hours; 3 credits |
| <a href="#">MTH 2120</a> | Mathematics Appreciation                    | 3 hours; 3 credits |
| <a href="#">MTH 2140</a> | Mathematics and Quantitative Reasoning      | 4 hours; 3 credits |
| <a href="#">MTH 2160</a> | Ideas in Mathematics and Their Applications | 4 hours; 3 credits |
| <a href="#">MTH 2205</a> | Applied Calculus II                         | 4 hours; 3 credits |
| <a href="#">MTH 2206</a> | Applied Calculus                            | 3 hours; 3 credits |
| <a href="#">MTH 2207</a> | Applied Calculus and Matrix Applications    | 4 hours; 4 credits |
| <a href="#">MTH 2301</a> | Concepts of Discrete Mathematics            | 3 hours; 3 credits |
| <a href="#">MTH 2610</a> | Calculus I                                  | 4 hours; 4 credits |
| <a href="#">MTH 2630</a> | Analytic Geometry and Calculus I            | 5 hours; 5 credits |
| <a href="#">MTH 3006</a> | Integral Calculus                           | 4 hours; 4 credits |
| <a href="#">MTH 3010</a> | Elementary Calculus II                      | 4 hours; 4 credits |
| <a href="#">MTH 3020</a> | Intermediate Calculus                       | 4 hours; 4 credits |
| <a href="#">MTH 3030</a> | Analytic Geometry and Calculus II           | 5 hours; 5 credits |

|                          |                                                         |                    |
|--------------------------|---------------------------------------------------------|--------------------|
| <a href="#">MTH 3040</a> | Actuarial Science Theory and Problem Seminar            | 2 hours; 2 credits |
| <a href="#">MTH 3050</a> | Multi-Variable and Vector Calculus                      | 4 hours; 4 credits |
| <a href="#">MTH 3100</a> | Selected Topics in Discrete Mathematics                 | 3 hours; 3 credits |
| <a href="#">MTH 3120</a> | Elementary Probability                                  | 3 hours; 3 credits |
| <a href="#">MTH 3300</a> | "Algorithms, Computers, and Programming I"              | 4 hours; 3 credits |
| <a href="#">MTH 3901</a> | Actuarial Science Internship                            | 1 hour; 1 credit   |
| <a href="#">MTH 3902</a> | Actuarial Science Internship                            | 1 hour; 1 credit   |
| <a href="#">MTH 3903</a> | Actuarial Science Internship                            | 1 hour; 1 credit   |
| <a href="#">MTH 3904</a> | Actuarial Science Internship                            | 1 hour; 1 credit   |
| <a href="#">MTH 3905</a> | Math Internship                                         | 1 hour; 1 credit   |
| <a href="#">MTH 3906</a> | Math Internship                                         | 1 hour; 1 credit   |
| <a href="#">MTH 3907</a> | Math Internship                                         | 1 hour; 1 credit   |
| <a href="#">MTH 3908</a> | Math Internship                                         | 1 hour; 1 credit   |
| <a href="#">MTH 4000</a> | Bridge to Higher Mathematics                            | 4 hours; 3 credits |
| <a href="#">MTH 4005</a> | Problem-Solving Seminar                                 | 3 hours; 3 credits |
| <a href="#">MTH 4010</a> | Advanced Calculus I                                     | 3 hours; 3 credits |
| <a href="#">MTH 4020</a> | Advanced Calculus II                                    | 3 hours; 3 credits |
| <a href="#">MTH 4030</a> | Topology                                                | 3 hours; 3 credits |
| <a href="#">MTH 4100</a> | Linear Algebra and Matrix Methods                       | 3 hours; 3 credits |
| <a href="#">MTH 4110</a> | Ordinary Differential Equations                         | 3 hours; 3 credits |
| <a href="#">MTH 4115</a> | Numerical Methods for Differential Equations in Finance | 4 hours; 4 credits |
| <a href="#">MTH 4120</a> | Introduction to Probability                             | 4 hours; 4 credits |
| <a href="#">MTH 4125</a> | Introduction to Stochastic Processes                    | 4 hours; 4 credits |
| <a href="#">MTH 4130</a> | Mathematics of Statistics                               | 4 hours; 4 credits |
| <a href="#">MTH 4135</a> | Computational Methods in Probability                    | 4 hours; 3 credits |
| <a href="#">MTH 4140</a> | Graph Theory                                            | 3 hours; 3 credits |
| <a href="#">MTH 4145</a> | Mathematical Modeling                                   | 3 hours; 3 credits |
| <a href="#">MTH 4150</a> | Combinatorics                                           | 3 hours; 3 credits |
| <a href="#">MTH 4200</a> | Theory of Numbers                                       | 3 hours; 3 credits |
| <a href="#">MTH 4210</a> | Elements of Modern Algebra                              | 3 hours; 3 credits |

|                           |                                                            |                                  |
|---------------------------|------------------------------------------------------------|----------------------------------|
| <a href="#">MTH 4215</a>  | "Finite Fields, Algebraic Curves, and Applications"        | 3 hours; 3 credits               |
| <a href="#">MTH 4230</a>  | History of Mathematics                                     | 4 hours; 4 credits               |
| <a href="#">MTH 4240</a>  | Differential Geometry                                      | 3 hours; 3 credits               |
| <a href="#">MTH 4300</a>  | "Algorithms, Computers, and Programming II"                | 4 hours; 3 credits               |
| <a href="#">MTH 4310</a>  | Methods of Numerical Analysis                              | 3 hours; 3 credits               |
| <a href="#">MTH 4315</a>  | Introduction to Mathematical Logic                         | 4 hours; 3 credits               |
| <a href="#">MTH 4320</a>  | Fundamental Algorithms                                     | 4 hours; 3 credits               |
| <a href="#">MTH 4340</a>  | Switching Theory                                           | 3 hours; 3 credits               |
| <a href="#">MTH 4395</a>  | Special Topics in Computer Science                         | 3 hours; 3 credits               |
| <a href="#">MTH 4400</a>  | Finite Differences                                         | 4 hours; 4 credits               |
| <a href="#">MTH 4410</a>  | Theory of Interest                                         | 4 hours; 4 credits               |
| <a href="#">MTH 4420</a>  | Actuarial Mathematics                                      | 4 hours; 4 credits               |
| <a href="#">MTH 4421</a>  | Actuarial Mathematics II                                   | 4 hours; 4 credits               |
| <a href="#">MTH 4451</a>  | Risk Theory                                                | 4 hours; 4 credits               |
| <a href="#">MTH 4500</a>  | Introductory Financial Mathematics                         | 4 hours; 4 credits               |
| <a href="#">MTH 4600</a>  | Data Analysis and Simulation for Financial Engineers       | 4 hours; 4 credits               |
| <a href="#">MTH 5000</a>  | Independent Study I                                        | Hours and credits to be arranged |
| <a href="#">MTH 5001</a>  | Independent Study II                                       | Hours and credits to be arranged |
| <a href="#">MTH 5002</a>  | Independent Study III                                      | Hours and credits to be arranged |
| <a href="#">MTH 5003</a>  | Independent Study IV                                       | Hours and credits to be arranged |
| <a href="#">MTH 5004</a>  | Independent Study V                                        | Hours and credits to be arranged |
| <a href="#">MTH 5010</a>  | Advanced Calculus III                                      | 3 hours; 3 credits               |
| <a href="#">MTH 5020</a>  | Theory of Functions of a Complex Variable                  | 3 hours; 3 credits               |
| <a href="#">MTH 5030</a>  | Theory of Functional of Real Variables                     | 3 hours; 3 credits               |
| <a href="#">MTH 5100</a>  | Partial Differential Equations and Boundary Value Problems | 4 hours; 4 credits               |
| <a href="#">MTH 5500</a>  | Stochastic Calculus for Finance                            | 4 hours; 4 credits               |
| <a href="#">MTH 6001H</a> | Honors in Mathematics I                                    | Hours and credits to be arranged |
| <a href="#">MTH 6002H</a> | Honors in Mathematics II                                   | Hours and credits to be arranged |
| <a href="#">MTH 6003H</a> | Honors in Mathematics III                                  | Hours and credits to be arranged |

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