Mathematics

Program Information for Undergraduate Majors

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University at Buffalo The State University of New York

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ADMINISTRATIVE DIRECTORY

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On the cover: Fibonacci numbers.
Fibonacci numbers are numbers in the sequence 1,1,2,3,5,8,13,... where each number is the sum of the two numbers preceeding it. These numbers appear in many patterns observed in nature. In particular they show up in the pattern of seeds in a sunflower. Leaves artwork designed by Freepik.

Table of Contents

GS (B.A.)
**General Study
in Mathematics BA**

A basic theoretical program suitable for students who intend to pursue graduate study in mathematics. This program is similar to BSc but involves fewer math electives.

BSc (B.S.)
**General Study
in Mathematics BS**

A basic theoretical program suitable for students who intend to pursue graduate study in mathematics. This program is similar to GS, but leads to a B.S. degree and requires four more electives.

M/E (B.A.)
**Joint Major in
Mathematics and Economics**

A joint major program with the Department of Economics. Suitable for students intending to pursue graduate study in economics.

GS/AM (B.A.)
**General Study in
Applied Mathematics BA**

A basic program suitable for students who intend to pursue graduate study in applied mathematics. This program is similar to BSc/AM, but requires fewer electives.

BSc/AM (B.S.)
**General Study in
Applied Mathematics BS**

A basic program suitable for students who intend to pursue graduate study in applied mathematics. This program is similar to GS/AM, but leads to a B.S. degree and requires four more electives.

Math Major Concentrations at a Glance

A (B.S.)
Actuarial Science

This program provides a curriculum for students intending to pursue a career of an actuary. It is also suitable for students who want to work in the financial sector.

M/P (B.S.)
**Joint Major in
Mathematical Physics**

A joint major program with the Department of Physics. Suitable for students intending to pursue graduate study in mathematical physics.

GC (B.A.)
**General Curriculum
in Mathematics**

A basic liberal arts program in mathematics. Well suited to students pursuing multiple majors.

C (B.A.)
**Computing and
Applied Mathematics**

A program for students interested in careers as applied mathematicians and computer programmers. Combines courses in mathematics, programming, data structures, and numerical analysis.

GS/ED (B.A.)
**General Study in Mathematics
and Education**

A program for students who plan to be mathematics teachers. Completion of this program provides advanced status toward initial NYS teacher certification.

BA/MA (B.A./M.A.)
**Combined Degree Program
in Mathematics**

A five year program suitable for students interested in teaching, financial applications, actuarial work, and any other profession in which advanced mathematical training and degree are valued.

How to Become a Math Major

1. **Seek advisement early.** If you are interested in becoming a math major, you should meet with the Director of Undergraduate Studies in the Math Department soon after beginning your studies at UB. Many of our program concentrations require extensive coursework which is difficult to complete without an early developed plan of study. Early planning is also very important if you intend to pursue a double degree or a double major. The initial meeting with the Director of Undergraduate Studies does not commit you to anything, but it is an opportunity to discuss the concentrations we offer and to clarify which programs are best suited to your needs.

2. **Complete the prerequisites.** Before you can be officially admitted to the math major, you need to complete prerequisite courses. For most of the math concentrations, the prerequisites are the three courses in the calculus sequence: MTH 141 Calculus I, MTH 142 Calculus II, and MTH 241 Calculus III. Your cumulative GPA in these courses must be at least 2.5. While this is not a requirement, it is recommended that before you seek admission to the more theoretically oriented programs (GS, BSc, GS/AM, BSc/AM, BA/MA) you should take the course MTH 311 Introduction to Higher Mathematics. This is an introductory proof-based course that will give you a taste of what to expect in all higher level mathematics courses and will test your aptitude toward abstract mathematics.

3. **Apply for admission.** Once you completed the prerequisites, you will be ready to apply for admission to the math major. You can apply in person only, by scheduling a meeting with the Director of Undergraduate Studies. At this meeting you will discuss your choice of concentration and plan your courses for the next few semesters. Upon approval your university status will be updated in the HUB - you will officially become a math major.

Advanced Placement Credit

Students who receive a grade 4 or 5 on the BC Calculus Advanced Placement Exam may receive credit for MTH 141 and MTH 142 (8 credit hours). Students who receive a grade of 4 or 5 on the AB Calculus Advanced Placement Exam may receive credit for MTH 141 (4 credit hours). This credit can be applied to the math major program requirements.

Transfer Students

If you are a transfer student and you intend to major in mathematics, you should consult with the Director of Undergraduate Studies very early in your first semester at UB to determine equivalency of transferred mathematics coursework. Transfer students are required to complete at least four upper division mathematics courses (i.e. courses above MTH 309) at UB if they are pursuing a math major, and at least two upper division mathematics courses for the math minor.

Double Degrees & Double Majors

Establishing expertise in multiple disciplines can enhance your job prospects and help in your post-college career. One way to achieve this is to obtain degrees in two areas. This can be done by completing either a double degree or a double major. The following table summarizes the requirements for a double degree and a double major and shows differences between these two options:

Double Degree	Double Major
You must pursue two majors in two different baccalaureate types (e.g. a B.A. in Mathematics and a B.S. in Chemical Engineering). Your transcript will specify two separate degrees and two majors.	You must pursue two majors in the same baccalaureate type (e.g. a B.S. in Mathematics and a B.S. in Physics). Your transcript will specify one degree and two majors.
You must complete all requirements for both programs.	You must complete all requirements for both programs.
You must complete at least 30 credits hours beyond the requirements of the degree with the larger number of required credits.	There are no restrictions on the number of credit hours you must complete.
You must accrue at least 150 credits total.	You must accrue at least 120 credits total (same as for a single major).
The only courses that can overlap between the two degrees are MTH 141, 142 (or 154), 241, 306, 309, and at most two additional courses at the 300- or 400-level. All other courses used for one degree cannot be used for the other. Before you graduate you will be required to complete the double degree application form listing all 300- and 400-level courses you took in each degree program. The form will need to be signed by the undergraduate directors and submitted to the Office of the Registrar.	Any number of courses can be used to satisfy requirements of both programs.
Upon graduation you will receive two diplomas, one for each degree awarded.	Upon graduation you will receive one diploma listing both majors.

If you wish to pursue a double degree or a double major you should plan for it early in your academic career, with the guidance of both program directors to prepare a plan of study that meets the above criteria.

Suggested Minors for Math Majors

As a mathematics major you may want to complement your training with a minor in an area related to your major program. Skills in programming, statistics, business, finance etc. are very compatible with the abilities we expect from our majors. A background in one of these areas will broaden the range of your potential career choices and can give you a competitive edge on the job market.

Computer Science Minor

Requires six CSE courses, with at least two at the 300-level or above. A minimum GPA of 2.0 overall in those courses is required. At least three courses must be taken at UB. A maximum of two of these courses may be used for a student's major.

Physics Minor

Prerequisites: MTH 141, MTH 142, PHY 107, PHY 108, PHY 158.

Required Courses: PHY 207, PHY 208, PHY 301, PHY 403, and one 300/400-level PHY elective course.

Chemistry Minor

Prerequisites: CHE 101 or CHE 105 or CHE 107, and MTH 141.

Required Courses: CHE 102 or CHE 106 or CHE 108, CHE 201-CHE 202, MTH 142, and 10 additional credit hours in 300/400-level chemistry courses.

Philosophy Minor

There are two programs suitable for math majors:
- Logic
- Philosophy of Science

Each of them requires six philosophy courses.

Statistics Minor

Prerequisites: MTH 141, MTH 142, and STA 119.

Required Courses: STA 301 or MTH 411, STA 302, STA 403, and STA 404.

Note: Actuarial math majors can complete this minor without taking any extra courses.

Economics Minor

Required Courses: MTH 141, MTH 142, ECO 405, ECO 407, ECO 480 (may substitute MTH 411/STA 301 and STA 302), 6 additional credits in 300/400-level economics courses.

Note: Actuarial math majors will complete all requirements of this minor in the course of their study.

Education Minor

Required Courses: LAI 350, CEP 400, ELP 405, and three elective courses.

Note: Math majors pursuing the GS/ED concentration will complete all requirements of this minor in the course of their study.

Geography Minor

There are five areas of specialization in the geography minor. Contact the Director of Undergraduate Studies at the Department of Geography for details.

Honors & Distinctions

There are three kinds of honors and distinctions you can earn as a math major. Latin Honors are awarded by UB based on the cumulative GPA in all courses. Separately the Department of Mathematics awards distinctions based on the GPA in courses that fulfill requirements of the math major. You can also earn honors by maintaining a high GPA and writing an honors thesis.

Latin Honors

Eligibility for Latin Honors is based on the UB cumulative GPA as specified in the table. To qualify for Latin Honors, you must complete at least 60 credit hours in undergraduate courses taken at UB. No less that 54 of these credits must be graded credits (i.e. not grades of 'P,' 'NP,' 'S' or 'U').

GPA	Honors
3.20	*cum laude*
3.50	*magna cum laude*
3.75	*summa cum laude*

Math Department Honors and Distinctions

Mathematics majors can graduate with a "Distinction", "High Distinction", or "Highest Distinction" based on criteria described in the following table:

Number of MTH courses taken above MTH 309	Math program GPA needed to graduate with:		
	distinction	*high distinction*	*highest distinction*
4	4.0	not eligible	not eligible
5	3.9	4.0	not eligible
6	3.8	3.9	3.95
7	3.7	3.8	3.85
8	3.6	3.7	3.75
9	3.5	3.6	3.75
10	3.4	3.5	3.75
11	3.3	3.5	3.75
12+	3.2	3.5	3.75

Note. The GPA used to determine eligibility for distinctons is computed from courses used to fulfill requirements of the math major program and any additional math courses taken by the student. Transfer students must complete at least 50% of math major credit hours at UB to be eligible.

In order to earn Math Department Honors a student must:

• Complete an honors thesis under guidance of a faculty member. Typically students register for MTH 499 Independent Study in the Fall semester and for MTH 497 Honors Thesis in the Spring semester of their senior year. Timing is flexible though and an honors thesis can be completed before the senior year.

• Complete at least 50% of math major credit hours at UB.

• Maintain GPA as specified in the table for Math Department distinctions. Completion of an honors thesis does not guarantee any form of honors for a student whose math major GPA is not high enough for a distinction.

Students who meet these requirements graduate with "Honors and Distinction", "High Honors and Distinction" or "Highest Honors and Distinction" following the table for the Math Department distinctions.

Undergraduate Mathematics Scholarships

Thanks to the generosity of our alumni and friends the Department of Mathematics awards each year several scholarships for undergraduate students. Information on applying is emailed to all math majors and posted around the department each Spring semester. If you have questions please contact the Office of Undergraduate Studies.

Harry Merrill Gehman Scholarship

The Gehman scholarship is awarded each spring to one or more mathematics majors who have a demonstrated interest in teaching. In 1995 Robert C. Luippold, University of Buffalo Class of 1940 and 1942, created the endowment for this scholarship in order to honor the memory of his mentor, Dr. Harry Merrill Gehman. Dr. Gehman came to UB in 1929 where he served as the Chair of the Mathematics Department for 33 years until 1962. He retired from UB in June 1968 with the title of professor emeritus. He died in 1981.

Hazel and John Wilson Scholarship

The Wilson Scholarship is awarded each spring to one or more outstanding mathematics majors on the basis of financial need, academic achievement and potential. John Wilson was a 1967 University at Buffalo graduate in Mathematics. Until 2000 he was employed as a mathematician at Calspan, where he led a group responsible for numerical analysis and applications. On his death in 2006, he left half his estate to endow this scholarship in his and his mother's names. His generous bequest was to recognize the opportunity he felt UB and the mathematics program gave him and to help provide similar opportunities to others.

Harriet F. Montague Award

The Harriet F. Montague Award is given each year to a junior who has demonstrated "intellectual and creative promise in mathematics." It was established to commemorate the career of Dr. Harriet F. Montague, who was one of the early graduates in our own mathematics program, and who returned to chair the Department for many years.

Summer Math Scholarships

Summer Math Scholarships provide funding for math majors who want to pursue a research project in mathematics over summer mentored by a faculty member. One scholarship in the amount of $3000.00 is awarded each year. Applications are solicited during each Fall semester. Funding for these scholarships has been provided by the Summer Math Foundation, Inc.

The Woeppel Fund

The fund's purpose is "to defray the expenses of undergraduate students who attend conferences or participate in other types of academic travel experiences that serve to enrich the learning process for undergraduate students in the Math Department." Interested students should contact the Undergraduate Director about obtaining financial support from the fund. The Woeppel Fund was created thanks to a generous donation of Dr. James Woeppel. Dr Woeppel earned his BA in mathematics at UB in 1965 and his doctorate from the University of Illinois in 1970. He recently has retired after a long career at Indiana University.

Extracurricular Mathematics Programs

If you are thinking of a career in mathematics or some related field, then in addition to taking math courses offered at UB you should consider participating in a mathematics program at another institution. This is particularly important if you want to pursue a graduate degree in mathematics: many highly ranked graduate programs expect that students applying for admission have such experience. Even if your planned career does not involve a PhD in mathematics, listing participation in such programs on your resume will help you stand out among other job applicants. Most importantly though, these programs are a great opportunity to learn a lot, see how mathematics is done elsewhere, and make new friends.

There are numerous mathematics programs for undergraduates. Most are conducted over summer at various location throughout the United States and abroad. Many programs provide stipends covering all expenses. Some examples of such programs are listed below. This list is not exhaustive: you can look for additional opportunities by searching the web for e.g. "summer mathematics undergraduate program". Contact the Office of Undergraduate Studies if you need more information or help applying.

Note. The following program descriptions were prepared based on information available in June 2016. The Math Undergraduate Office will distribute more up-to-date information as it becomes available

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Research Experience for Undergraduates (REU)

Where:	Numerous universities throughout the United States.
When:	6-8 weeks during summer.
For Whom:	Math and science majors. US citizens and permanent residents only.
Cost:	Participants usually receive stipends covering all their expenses.
Website:	See the following website for a list of REU programs: www.nsf.gov/crssprgm/reu/
Description:	REUs are programs funded by the National Science Foundation and run by various Math Departments throughout the country. REU participants work with faculty advisors on research projects.

Summer Undergraduate Applied Mathematics Institute

Where:	Carnegie Mellon University, Pittsburgh, PA.
When:	7 weeks during summer.
For Whom:	Math majors, sophomores and juniors who are considering graduate study in mathematics.
Cost:	US citizens or permanent residents receive stipends covering their expenses. Non-US residents must pay a registration fee and cover their living expenses.
Website:	www.math.cmu.edu/CNA/summer_institute.html
Description:	This program gives students a taste of what graduate study in mathematics feels like. Participants take courses in applied mathematics and computer programming, and work with faculty members on projects in applied mathematics.

NSA Director's Summer Program

Where: National Security Agency, Fort Meade, MD.

When: 12 weeks during summer.

For Whom: Math, physics and computer science majors. US citizens only.

Cost: Participants receive a plane ticket, subsidized housing and a salary.

Website: See the following wehsite for information about this and other NSA programs for undergraduates: www.intelligencecareers.gov/icstudents.html

Description: Students take courses on modern cryptography and collaborate with NSA mathematicians on research projects. Note: the application deadline is very early (October 15).

NIST Summer Undergraduate Research Fellowship

Where: National Institute of Standards and Technology, Gaithersburg, MD and Boulder, CO,

When: 11 weeks during summer.

For Whom: Undergraduate students in STEM majors. US citizens and permanent residents only.

Cost: Participants receive a travel allowance, room and board, and a stipend.

Website: www.nist.gov/surf

Description: Program participants work on research projects related to mathematics, engineering, materials science, computer science etc. under mentorship of NIST scientists. Note: you cannot apply to this program on your own, the application must be submitted on your behalf by UB. Contact the Math Undergraduate Director if you are interested in applying

Women and Mathematics

Where: Institute for Advanced Study, Princeton, NJ.

When: 11 days, usually in May.

For Whom: Students (not only females) of junior or senior status.

Cost: Participants receive support for lodging, meals and transportation.

Website: www.math.ias.edu/wam

Description: The Institute for Advanced Study is one of the most prestigious research institutions in the world. The program brings together research mathematicians with undergraduate and graduate students. Activities include lectures and seminars on a focused mathematical topic, mentoring, and discussions of career opportunities.

MSRI-UP

Where: Mathematical Sciences Research Institute, Berkeley, CA.

When: 6 weeks during summer.

For Whom: Students who have completed two years of college mathematics courses. US citizens and permanent residents only.

Cost: Participants receive a travel allowance, room and board, and a stipend.

Website: www.msri.org/web/msri/education/for-undergraduates/msri-up

Description: MSRI is a major mathematics research center. Students participating in MSRI-UP work on research projects under direction of faculty and graduate student mentors.

Undergraduate Teaching Assistant Program

The Undergraduate TA Program is an opportunity to gain teaching experience by serving as a Teaching Assistant for mathematics courses. Each undergraduate TA teaches two recitation sections in a course ranging from MTH 121 to MTH 309. Undergraduate TAs are not paid, but they earn 3 credits for the course MTH 495 Undergraduate Supervised Teaching.

Prerequisites

- In order to participate in this program you must have a junior status or above (i.e. at least 60 credit hours completed) and you must be a math major.
- Your overall GPA must be at least 3.0 and you must have either A or A- in MTH 141, 142, and 241. Completion of several more mathematics courses is usually expected.
- You must have very good communication skills, including excellent spoken English.
- If you were an undergraduate TA once in the past you can apply again, but you can't be an undergraduate TA more than twice.

Undergraduate TA Responsibilities

- Attend a training session during the first week of the semester. Recitations do not start until the second week of classes.
- Lead two 50 minute recitations each week.
- Hold office hours for two hours each week. The Math Department will provide an office space for this.
- Depending on the course instructor you may be asked to help with grading of exams under supervision, preparation and grading of quizzes etc. You may also be asked to provide feedback to the instructor on how the students are doing.

The total commitment (including preparation, teaching, and office hours) is about 10-12 hours per week.

Application Process

- Application forms are e-mailed to all math majors in the second half of each semester. They can be also picked up in the Math Undergraduate Office.

- Toward the end of the semester qualified applicants will be invited for an interview.
- If you are selected as a TA will be asked for a list of classes you would like to teach. You will never be assigned to a class you are not comfortable teaching or one that conflicts with the schedule of your courses.
- We will let you know which recitations you will teach a few weeks before classes start. At that point you will be force registered to the 3-credit course MTH 495 Undergraduate Supervised Teaching.

Note: The course MTH 495 cannot be used as a mathematics elective in any concentration of the math major program.

Career Options for Math Majors

There are two concentrations offered by the Math Department that were created with specific careers in mind. The actuarial concentration (A) prepares for the profession of an actuary, and the GS/ED concentration is designed for students who want to teach mathematics in a high school or a middle school. The other concentrations are not so focused on one, specific profession. One reason behind it is that there are many possible career paths for mathematicians (see the websites listed below for more information). Secondly, in order to get a job as a mathematician in almost any setting, one needs to have a graduate degree: MA, MS or a PhD. As a result the primary goal of several of our concentrations is to provide a thorough preparation for graduate studies in mathematics, statistics, mathematical finance, mathematical physics, and in other areas. You should also keep in mind that mathematical training with the skills it brings (analytical thinking, problem solving etc.) is valued in many professions. Students who graduate with a math degree frequently have successful careers in areas that are not directly related to mathematics.

Whatever your interests are, you should start thinking early on what career you want to pursue and plan your studies accordingly (we will be happy to help you with planning). Your goals may change over time, but you will be able to achieve them only if you set them first. For information on professional careers for mathematicians check the following websites:

- stats.bls.gov/ooh/Math/
- weusemath.com
- www.maa.org/careers/
- www.careercornerstone.org/math/math.htm
- www.siam.org/careers/thinking.php

Where Are Our Alumni?

Here is a partial list of placements of students who graduated from our department in the last few years:

- Graduate program in mathematics (UB, UCLA, Brown, RPI, U Oregon, U Arizona, U Iowa, U Hawaii, U Pittsburgh, Northwestern, UIUC, Notre Dame, NYU, U Georgia)
- Graduate program in statistics (Columbia, Duke, Northwestern)
- Graduate program in physics (UB, Cornell, UC Davis, UC Berkeley, UC San Diego, U Chicago, Rice)
- Graduate program in chemistry (Columbia, Northwestern)
- Graduate program in education (UB, Rochester, Canisius, Buff State, Itaca College, CUNY, Purdue)
- Graduate program in economics (Penn State, U Pittsburgh, Georgetown)
- Graduate program in computer science (UB, Purdue, UIUC, U Washington, Columbia, NYU, WUSL)
- Graduate program in operations research (Cornell)
- Graduate program in accounting (UB, U Texas Austin)
- Graduate program in engineering (UB, Columbia, Ohio State, UC Santa Barbara, U Delaware, Johns Hopkins, U Michigan, Carnegie Mellon, NYU, Texas A&M)
- Law School (Duke, Columbia, Notre Dame)
- Medical School (UB, Stony Brook, SUNY Upstate Medical College, NYIT)
- Insurance and actuarial consulting companies (BCBS of WNY, Independent Health, Buck Consultants, Travelers Insurance, Milliman, Liberty Mutual, Merchants Insurance Group)
- Hi-tech industry (Sandia Labs, Google, Twitter, Facebook, Praxair, CUBRC, AECOM, NSA, CoachMePlus, Fidessa. Amazon)
- Financial Institutions (Fidelity Investments, Ernst & Young, M&T Bank, AXA Advisors, Mizuho Bank, FactSet Research Systems, Liberty Mutual, Fiserv, HSBC, Citi Group, Goldman Sachs)

Applying to a Graduate School

Below are some steps you should take if you plan to apply to a graduate program in mathematics. You don't necessarily need to do every single thing on this list. You should keep in mind though that your graduate school application will be evaluated based on your potential for doing research in mathematics. Anything you can do to demonstrate this potential will help. Please contact the Undergraduate Director if you have any questions, need help selecting graduate programs to apply to, or if you need assistance with the application process.

1. **Plan well ahead.** The graduate school application process is a long one, and you should start seriously preparing for it (by researching graduate programs, studying for the GREs etc.) definitely no later that the Spring semester on your junior year. Several steps outlined below require even earlier planning. The sooner you start preparing for a graduate school the more options you will have as to which schools you can reasonably apply to and the bigger chances that you will get accepted to a high quality program.

2. **Take as many advanced math classes as you can handle.** When you will be applying to graduate schools your GPA will be a major factor. The minimum GPA in math courses required for admission usually ranges between 3.2 and 3.5 (depending on the university). Equally important will be the number and variety of mathematics courses you took. For example, completion of the bare requirements of the GC concentration even with a very high GPA is not a sufficient background for a graduate school applicant. If you are doing very well in 400-level math classes, ask your professors if they think you may be ready for a 500- or 600-level graduate course. Taking such a course will strengthen your math credentials and give you a taste of graduate coursework. Each year we have a few undergraduates who take and sometimes excel in these graduate courses.

3. **Write an honors thesis.** Writing an honors thesis is highly recommended for at least two reasons. First, is it a way of gaining research experience, which is very highly valued by graduate schools. Secondly, each thesis is written under an individual supervision of a faculty member whom you can ask to write a reference letter for your graduate school application. As a bonus, if you write a thesis and your GPA is high enough you will graduate with honors (see page 6 for details).

4. **Participate in extracurricular mathematics programs.** Extracurricular mathematics programs (REUs, undergraduate math conferences etc.) provide excellent opportunities for gaining experience with research and learning advanced math topics. Participation in such programs will also demonstrate your interest in and dedication to mathematics. A summer research program sometimes can lead to a publication in a math journal which would greatly enhance your graduate school application. Also, faculty of these programs can provide reference letters for you. For more information on such programs see page 8.

5. **Participate in math contests.** Participation in mathematics contents can help demonstrate your skills and interest in mathematics. Here are some examples of college-level math competitions that are organized each year.

• The Putnam Exam is the most famous mathematics competition for US college students. The exam is given in December and it can be taken in our department. Exam problems do not involve very advanced mathematics but they require ingenuity and extensive training in problem solving skills. There are no easy Putnam problems, but each exam includes a couple that a good student with sufficient preparation should be able to tackle. If this does not sound too encouraging consider that in the last 20 years students needed on average just 20 points (out of 120) to be listed among top 500 (i.e. about top 15%) of all exam takers. Such achievement would be worth listing on a CV.

• University of Rochester Math Olympiad is orga-

nized each March and has a format similar to the Putnam exam. You don't need to travel to Rochester to participate - you can take this exam in our department.

• The Mathematical Contest in Modelling is a worldwide competition for undergraduate students. Over four days teams of students research a practical problem using mathematical tools, computer simulation etc., and write a paper describing their work and findings. The papers are submitted to the contest organizers for evaluation. The contest is held in January. In the last 10 years two teams of our students were awarded top prizes in this competition, placing ahead of several thousands of contestants from various countries.

6. **Get well acquainted with a few math professors.** A major component of your graduate school application will be reference letters (usually three are required) written by your mathematics professors. During your studies you should make yourself known to some professors so that they will be able to write something meaningful about you. Good choices for reference letter writers include your honors thesis advisor (if you had one), faculty of a summer research program (if you participated in one), and professors with whom you took small, advanced mathematics classes provided that you participated actively, attended office hours, and overall made yourself recognizable.

7. **Become an Undergraduate Math Teaching Assistant.** This suggestion is of somewhat less importance since graduate school applicants are not required to have teaching experience. On the other hand, though, graduate students almost always serve as teaching assistants and sometimes teach their own courses, so demonstrating ability to teach on a college level won't hurt. See page 10 for more information on the Undergraduate TA program.

8. **Take the General GRE test.** The General GRE is a standard test taken by graduate school applicants in various areas. Most graduate programs require that you take this test. General GRE is given year-round, and one testing location is on the UB campus. For more information see this website: www.ets.org/gre.

9. **Take the Subject Mathematics GRE.** Subject Math GRE is a test that can be taken separately from the General GRE and that is designed specifically for applicants to graduate programs in mathematics. Not all graduate programs require this test, but if you take it and get a high score, it will increase your chances of being accepted even at schools where this test is not officially required. You need to score above 50% to have a viable chance of getting admitted to a highly ranked program. As with any test the key to a good score on the Subject Math GRE is plenty of practice. This test is given only three times per year, so plan well in advance. For more information see this website: www.ets.org/gre/subject

10. **Write a personal statement.** As a part of your graduate school application you will be asked to write a personal statement. Remember that admission committee members in graduate programs go through dozens or hundreds of applications and look for specifics while scanning through the fluffy parts. With this in mind, concentrate on a concrete description of your mathematics-related accomplishments and interests. If you did well in a math contest, you should point it out. If you wrote an honors thesis or worked on a research problem, tell about your work. You should write about summer programs, undergraduate conferences etc. you participated in. If you received a scholarship or an award, you were an undergraduate TA, or took an active role in the math club, you should write about it as well. If there is an area of mathematics that particularly interests you, explain why. If some graduate program is especially attractive to you (e.g. you would love to work with a particular professor there or you know some of their graduate students) is it good to mention it. Don't make any of this up. Once you are finished writing your statement ask a faculty member (e.g. your honors thesis advisor or the Undergraduate Director) to read it and offer suggestions.

11. **Contact professors in programs you are applying to.** This tip should be treated judiciously. If you have a strong interest in a certain area of mathematics, and you know of a professor who works in that area at a university to which you are applying, then you can write to him or her, introduce yourself, and perhaps ask a couple of questions. You can also write to a professor whom you know personally (e.g. from a summer program you participated in). On the other hand, do not e-mail people at random.

Actuarial Careers

What do actuaries do?

In most businesses it is fairly straightforward to calculate the cost of products the business sells: one simply adds the costs of materials, labor, marketing, distribution etc. These costs are usually known before the product is sold to customers, so the price a customer pays can be set to include them all. In some cases, though, the process of computing costs and setting prices becomes more complicated. For example, when an insurance company sells a car insurance policy, it does not not know if the insured car will be involved in an accident and if so then how much the insurance claim will cost. In this case the price of the product (i.e. the insurance policy) must be set before it is known what the actual cost of the product (i.e. the value of claims paid) will be. Actuaries are professionals who deal problems of such type: they use mathematical methods and statistical analysis to estimate risk of future events and they put a price tag on that risk.

Where do actuaries work?

As the above example suggests, insurance companies are the biggest employers, but actuaries are also employed by consulting companies (e.g. estimating financial risk of corporate mergers etc.), banks (evaluating risk of financial investments), government agencies etc.

How to become an actuary?

In addition to a bachelor's degree with a strong mathematical background, actuaries must pass a series of exams and satisfy other requirements to earn the professional designation of an Actuarial Associate or an Actuarial Fellow. The actuarial exams are administered by the two largest actuarial associations in the US: the Society of Actuaries (SOA) and the Casualty Actuarial Society (CAS). In order to be hired for an entry-level position as an actuary, one usually needs to pass one or two of these exams. The more advanced exams can be completed while being employed as an actuary. Many companies provide time off for studying for these exams, cover the costs of exams and study materials, and also offer pay increases for each passed exam.

How to study to become an actuary?

1. While any math major concentration can provide sufficient mathematical background to get you started on the actuarial career path, if you are specifically interested in this profession you should consider the actuarial concentration (A). This concentration combines courses in mathematics, finance, economics, management, and computer science. Some of these courses are certified to satisfy the VEE (Validation by Educational Experience) requirements that will give you a head start in the Actuarial Associate certification process.

2. You should plan to pass the first two actuarial exams (Exam P - Probability, and Exam MF - Mathematical Finance) before the end of your college studies. Passage of at least one of these exams is usually required by employers for entry-level actuarial positions, and passage of both is preferred. You should try to pass the first of these exams before the end of your junior year since this will help you get an actuarial summer internship.

3. Apply for actuarial internships. Most of these internships are offered during summer, but some companies also offer internships involving part-time work during a semester. Most actuarial internships are paid. Beside providing a professional experience, internships often serve as extended job interviews: several of our students were offered regular positions at the conclusion of their internships, that they could accept after finishing their undergraduate degrees. Students typically apply for internships during their sophomore or junior year. Employers usually give preference to students who have at least one actuarial exam passed before the start of an internship. The Math Department sometimes receives information about internship positions and we e-mail it to all math majors. A list of companies offering internships is also posted on the SOA website:

www.soa.org/careers/atp/
actuarial-training-program.aspx

You may find additional opportunities by searching websites of insurance companies.

For more information on actuarial careers, actuarial exams etc. see these websites:

www.beanactuary.org
www.soa.org
casact.org
www.actuarialoutpost.com

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BSc General Study in Mathematics (B.S.)

GS General Study in Mathematics (B.A.)

These programs are suitable for students who intend to pursue graduate study in pure mathematics. The core courses in both of these programs are the same. The difference is that BSc leads to a B.S. degree and requires four more math elective courses than GS which leads to a B.A. degree.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, and MTH 241 (or equivalent courses for transfer students). Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I	MTH 142 Calculus II
2	MTH 241 Calculus III MTH 309 Intro Lin Algebra MTH 337 Intro Sci Computing	MTH 306 Intro Diff Eq MTH 311 Intro Higher Math
3	MTH 419 Intro Abstr Algebra MTH 431 Intro Real Var I	MTH 420 Adv Lin Algebra MTH 432 Intro Real Var II MTH elective
4	MTH/CSE elective MTH elective (BSc) MTH elective (BSc)	MTH/CSE elective MTH/CSE elective (BSc) MTH/CSE elective (BSc)

Advising Notes:
- If you are considering applying to a graduate school please see page 12.
- STA 301 and STA 302 can be used as elective courses.
- Courses MTH 417 and 495-499 are not acceptable as electives.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 311 Intro to Higher Mathematics	4		
MTH 337 Intro to Sci & Math Computing	4		
MTH 419 Abstract Algebra	4		
MTH 420 Advanced Linear Algebra	4		
MTH 431 Intro to Real Variables I	4		
MTH 432 Intro to Real Variables II	4		

MTH/CSE Electives (MTH/CSE 300/400-level, not MTH 495-499)

	Course	Credits	Grade	Semester
required for Bsc				

MTH Electives (MTH 300/400-level, not MTH 417, 495-499)

	Course	Credits	Grade	Semester
required for Bsc only				

BSc/AM General Study in Applied Mathematics (B.S.)

GS/AM General Study in Applied Mathematics (B.A.)

These programs are suitable for students who intend to pursue graduate study in applied mathematics. The core courses in both of these programs are the same. The difference is that BSc/AM leads to a B.S. degree and requires four more mathematics elective courses than GS/AM which leads to a B.A. degree.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, and MTH 241 (or equivalent courses for transfer students). Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I PHY 107 Gen Physics I	MTH 142 Calculus II PHY 108 Gen Physics II CSE 115 Intro Comp. Sci I
2	MTH 241 Calculus III MTH 309 Intro Lin Algebra MTH 337 Intro Sci Computing	MTH 306 Intro Diff Eq MTH 311 Intro Higher Math
3	MTH 431 Intro Real Var I MTH 417 Multivar Calculus Choose one course: MTH 419 Intro Abstr Algebra MTH 420 Adv Lin Algebra	MTH 418 Surv Partial Diff Eq MTH/CSE elective (BSc/AM)
4	MTH 443 Fund App Math I MTH/CSE elective MTH elective (BSc/AM)	MTH/CSE elective MTH elective (BSc/AM) MTH elective (BSc/AM)

Advising Notes:
- If you are considering applying to a graduate school please see page 12.
- STA 301 and STA 302 can be used as elective courses.
- Courses MTH 495-499 are not acceptable as electives.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 311 Intro to Higher Mathematics	4		
MTH 337 Intro to Sci Computing	4		
MTH 417 Multivariable Calculus	4		
MTH 418 Survey of Partial Diff Eq	4		
MTH 419 Abstr Alg / MTH 420 Adv Lin Alg	4		
MTH 431 Intro to Real Variables I	4		
MTH 443 Fund Applied Math I	4		
Required PHY courses			
PHY 107 General Physics I	4		
PHY 108 General Physics II	4		
Required CSE course			
CSE 115 Intro to Computer Science I	4		
MTH/CSE Electives (MTH/CSE 300/400-level, not MTH 495-499)			
MTH Electives (MTH 300/400-level, not MTH 495-499)			

required for Bsc/AM only

required for Bsc/AM only

A Actuarial Science (B.S.)

Actuarial Science uses mathematical and statistical methods to assess and manage risk. Actuaries play a key role in insurance companies, financial institutions, government agencies etc. This program provides a curriculum for students who want to work as actuaries. It is also suitable for students interested in careers related to finance.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, MTH 241, and STA 119 Statistical Methods. Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I STA 119 Statistical Methods	MTH 142 Calculus II
2	MTH 241 Calculus III MGA 201 Intro to Accounting I Choose one course: MTH 411 Probability Theory STA 301 Intro to Probability	MTH 309 Intro Lin Algebra MGA 202 Intro to Accounting II STA 302 Intro to Stat Inference
3	MTH 306 Intro Diff Eq MTH 337 Intro Sci Computing ECO 405 Microeconomic Theory Choose one course: STA 403 Regression Analysis MGQ 301 Stat Dec in Management	MTH 311 Intro Higher Math ECO 407 Macroeconomic Theory ECO 481 Econometrics II
4	MTH 458 Mathematical Finance I ECO 461 Eco Fluct & Forecast MGF 301 Corporation Finance	MTH 459 Mathematical Finance II MGF 405 Adv Corporate Finance STA elective

Advising Notes:
- STA 403 and STA 502 are not acceptable as a statistics elective.
- MGQ 201 is listed as a prerequisite for MGQ 301, but this requirement is waived for actuarial majors.
- This program has a long prerequisite sequence MTH 411/STA 301→STA 302→ECO 481→ECO 461. For this reason it is important to take MTH 411/STA 301 and STA 302 during the sophomore year.
- Students in this program will complete all requirements of the Economics Minor. They will also complete all requirements of the Statistics Minor as long as they take STA 403 (rather than MGQ 301) and then take STA 404 as the statistics elective course.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
STA 119 Statistical Methods	4		
Required MTH/STA courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 311 Intro to Higher Mathematics	4		
MTH 337 Intro to Sci Computing	4		
MTH 411 Prob Th / STA 301 Intro Prob	4		
STA 302 Intro to Stat Inference	4		
MTH 458 Mathematical Finance I	3		
MTH 459 Mathematical Finance II	3		
Required ECO courses			
ECO 405 Microeconomic Theory	3		
ECO 407 Macroeconomic Theory	3		
ECO 461 Eco Fluct & Forecasting	3		
ECO 481 Econometrics II	3		
Required MGA/MGF/MGQ courses			
MGA 201 Intro to Accounting I	3		
MGA 202 Intro to Accounting II	3		
MGF 301 Corporation Finance	3		
MGQ 301 Stat Dec / STA 403 Regr An	3		
MGF 405 Advanced Corporate Finance	3		
STA Elective (STA 400/500-level, not STA 403 or STA 502)			

C Computing and Applied Mathematics (B.A.)

This is a program for students interested in careers as applied mathematicians or scientific computer programmers. In addition to the standard mathematics courses, students in concentration C take a year of programming in a high-level language, a course on principles of digital systems, and a course on data structures. The culmination of this program is a year-long course of numerical analysis that shows how the mathematical and programming skills can be applied to problems arising in scientific and engineering practice.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, MTH 241. Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I CSE 115 Intro Comp Sci I	MTH 142 Calculus II CSE 116 Intro Comp Sci II
2	MTH 241 Calculus III CSE 241 Digital Systems CSE 191 Discrete Structures	MTH 309 Intro Lin Algebra CSE 250 Algorithms & Data Str
3	MTH 306 Intro Diff Eq Choose one course: MTH 431 Intro Real Var I MTH 417 Multivar Calculus	MTH elective Choose one course: MTH 432 Intro Real Var II MTH 418 Surv Partial Diff Eq
4	MTH 437 Intro Num Analysis I MTH elective MTH/CSE elective	MTH 438 Intro Num Analysis II MTH/CSE elective

Advising Notes:
- Students in this program must either select the course sequence MTH 417 - 418 or MTH 431 - 432.
- MTH 311 is a prerequisite for MTH 431. Students intending to pursue a graduate degree in mathematics should choose the course sequence MTH 311 - 431 - 432 instead of MTH 417 - 418. In such case the course MTH 311 will satisfy one of the mathematics electives requirements.
- STA 301 and STA 302 can be used as elective courses.
- Courses MTH 495-499 are not acceptable as electives.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 417 Multivar Calc / MTH 431 Real Var I	4		
MTH 418 Surv PDE / MTH 432 Real Var II	4		
MTH 437 Intro Numerical Analysis I	4		
MTH 438 Intro Numerical Analysis II	4		
Required CSE courses			
CSE 115 Intro to Computer Science I	4		
CSE 116 Intro to Computer Science II	4		
CSE 191 Discrete Structures	4		
CSE 241 Digital Systems	4		
CSE 250 Algorithms & Data Structures	4		
MTH/CSE Electives (MTH/CSE 300/400-level, not MTH 495-499)			
MTH Electives (MTH 300/400-level, not MTH 495-499)			

GS/ED General Study in Math & Education (B.A.)

This program is designed for students whose career goal is to earn a master's degree and a professional certification in adolescent mathematics education (grades 7-12). Completion of this program provides advanced status toward initial NYS teacher certification.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, and MTH 241. Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I	MTH 142 Calculus II Choose one course: CSE 113 Intro Comp Prog I CSE 115 Intro Comp Sci I
2	MTH 241 Calculus III CSE 191 Discrete Structures Choose one course: CSE 116 Intro Comp Sci II MTH 337 Intro Sci Computing	MTH 309 Intro Lin Algebra MTH 311 Intro Higher Math LAI 350 Intro to Education
3	MTH 306 Intro Diff Eq MTH 431 Intro Real Var I	MTH 335 Elements of Geometry CEP 400 Educational Psychology ELP 405 Sociology of Education
4	Education Elective Education Elective Choose one course: MTH 411 Probability Theory STA 301 Intro to Probability	MTH elective Education Elective Choose one course: MTH 419 Intro Abstr Algebra MTH 420 Adv Lin Algebra

Advising Notes:
- Courses that can be used as education electives are CEP 401, 404, 453, and LAI 205, 414, 416, 474, 490.
- STA 302 can be used as a mathematics elective.
- Courses MTH 495-499 are not acceptable as electives.
- Students in this program will complete all requirements of the Education Minor.
- Students considering this concentration you should consult with the Teacher Education Institute at the UB Graduate School of Education as early as your freshman year for advice NYS teacher certification process and selection of general education courses fulfilling the NYS Education Department requirements.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 311 Intro to Higher Mathematics	4		
MTH 335 Elements of Geometry	4		
MTH 411 Prob Th / STA 301 Intro Prob	4		
MTH 419 Abstr Alg / MTH 420 Adv Lin Alg	4		
MTH 431 Intro to Real Variables I	4		
Required CSE courses			
CSE 113 Intro Prog / CSE 115 Intro Comp Sc I	4		
MTH 337 Sci Comp / CSE 116 Intro Comp Sc II	4		
CSE 191 Discrete Structures	4		
Required CEP/ELP/LAI Courses			
CEP 400 Educational Psychology	3		
ELP 405 Sociology of Education	3		
LAI 350 Intro to Education	4		
MTH Elective (MTH 300/400-level, not MTH 495-499)			
Education Electives (choose 3 from: CEP 401, 404, 453 and LAI 205, 414, 416, 474, 490)			

M/E Joint Major in Mathematics and Economics (B.A.)

This is a program for students intending to pursue graduate study in economics. Since this is a joint major you must apply to it separately in the Mathematics Department and the Economics Department. After obtaining approval of the Director of Undergraduate Studies in Economics, you should see the Director of Undergraduate Studies in Mathematics to be formally admitted to this program.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, and MTH 241. Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I	MTH 142 Calculus II
2	MTH 241 Calculus III ECO 405 Microeconomic Theory	MTH 306 Intro Diff Eq MTH 309 Intro Lin Algebra ECO 407 Macroeconomic Theory
3	MTH 311 Intro Higher Math Choose one course: MTH 411 Probability Theory STA 301 Intro to Probability	STA 302 Intro to Stat Inference ECO elective MTH elective
4	MTH 431 Intro Real Var I ECO elective	Choose one course: MTH 419 Intro Abstr Algebra MTH 420 Adv Lin Algebra

Advising Notes:
- STA 302 can be used as a mathematics elective.
- Courses MTH 495-499 are not acceptable as mathematics electives.
- Courses ECO 480-481 are not acceptable as economics electives.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH/STA courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 311 Intro to Higher Mathematics	4		
MTH 411 Prob Th / STA 301 Intro Prob	4		
STA 302 Intro to Stat Inference	4		
MTH 419 Abstr Alg / MTH 420 Adv Lin Alg	4		
MTH 431 Intro to Real Variables I	4		
Required ECO courses			
ECO 405 Microeconomic Theory	3		
ECO 407 Macroeconomic Theory	3		
MTH Elective (MTH 300/400-level, not MTH 495-499)			
ECO Electives (ECO 300/400-level, not ECO 480-481)			

M/P Joint Major in Mathematical Physics (B.S.)

This is a program for students intending to pursue graduate study in mathematical physics. Since this is a joint major you must apply to it separately in the Mathematics Department and the Physics Department. After obtaining approval of the Director of Undergraduate Studies in Mathematics you should see the Director of Undergraduate Studies in Physics to be formally admitted to this program.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141 and MTH 142, as well as PHY 107 (or PHY 117), PHY 108 (or PHY 118), and PHY 158. Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I Choose one course: PHY 107 General Physics I PHY 117 Honors Physics I	MTH 142 Calculus II PHY 158 General Physics II Lab Choose one course: PHY 108 General Physics II PHY 118 Honors Physics II
2	MTH 241 Calculus III MTH 306 Intro Diff Eq PHY 208 General Physics IV	MTH 309 Intro Lin Algebra PHY 207 General Physics III PHY 257 General Physics III Lab
3	MTH 417 Multivar Calculus PHY 301 Intermed Mechanics I PHY 401 Modern Physics	MTH 418 Surv Partial Diff Eq PHY 307 Modern Physics Lab PHY elective
4	PHY 403 Electr & Magnetism I PHY 405 Thermal & Stat Phys I PHY 431 Mathematical Physics I Choose one course: MTH 419 Intro Abstr Algebra MTH 420 Adv Lin Algebra	MTH 425 Intro to Complex Var MTH elective Choose one course: PHY 407 Adv Physics Lab MTH 408 Adv Physics Lab

Advising Notes:
- Courses that can be used as a physics elective are PHY 302, 402, 404, 406.
- Courses MTH 495-499 are not acceptable as mathematics electives.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
PHY 107 Gen Phys I / PHY 117 Honors Phys I	4		
PHY 108 Gen Phys II / PHY 118 Honors Phys II	4		
PHY 158 General Physics II Lab	1		
Required MTH courses			
MTH 241 Calculus III	4		
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 417 Multivariable Calculus	4		
MTH 418 Survey of Partial Diff Eq	4		
MTH 419 Abstr Alg / MTH 420 Adv Lin Alg	4		
MTH 425 Intro to Complex Var	4		
Required PHY courses			
PHY 207 Gen Physics III	4		
PHY 208 General Physics IV	3		
PHY 257 General Physics III Lab	1		
PHY 301 Intermediate Mechanics I	3		
PHY 307 Modern Physics Lab	2		
PHY 401 Modern Physics I	3		
PHY 403 Electricity & Magnetism I	3		
PHY 405 Thermal & Stat Physics I	3		
PHY 407 Adv Lab / PHY 408 Adv Lab	3		
PHY 431 Mathematical Physics I	3		
MTH Elective (MTH 300/400-level, not MTH 495-499)			
PHY Elective (one of PHY 302, 402, 404, 406)			

GC General Curriculum in Mathematics (B.A.)

This is a basic liberal arts program in mathematics. It is well suited to students pursuing mathematics as the second major. It is also suitable as a backup plan: students enrolled in any mathematics concentration and pressed for time can switch to GC to graduate on schedule. However, if mathematics is your main interest you should consider other math concentrations that offer more extensive training and better defined career options.

Admission requirements. In order to be accepted to this concentration you need to complete the calculus courses MTH 141, MTH 142, and MTH 241 (or equivalent courses for transfer students). Your GPA in these courses must be at least 2.5.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I	MTH 142 Calculus II
2	MTH 241 Calculus III	MTH 309 Intro Lin Algebra
3	MTH 306 Intro Diff Eq	MTH 311 Intro Higher Math MTH elective
4	MTH elective	MTH elective

Advising Notes:
- Your overall GPA in the nine mathematics courses listed above must be at least 2.50 to graduate in the GC program. This requirement is strictly enforced. If you fail to meet this condition you may take additional mathematics courses approved by the Director of Undergraduate Studies to achieve a package of nine courses with GPA of 2.50 or higher.
- STA 301 and STA 302 can be used as elective courses.
- Courses MTH 495-499 are not acceptable as electives.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH 311 Intro to Higher Mathematics	4		
MTH Electives (MTH 300/400-level, not MTH 495-499)			

BA/MA Combined Degree Program in Mathematics (B.A./M.A.)

This is a five-year program combining undergraduate and graduate coursework and leading to the B.A./M.A. degree. The BA/MA program is suitable for students interested in teaching, financial applications, actuarial work, and any other profession in which advanced mathematical training and degree are valued.

Admission requirements. In order to be accepted to this program you need to complete the calculus sequence: MTH 141, 142, 241, as well as MTH 309 and MTH 306. Your GPA in these courses must be at least 3.0. Admission to the graduate portion of the program requires approval by the Director of Graduate Studies in Mathematics.

Calendar. This is a suggested calendar. Although all courses listed below are required there is some flexibility with regard to which semester these courses should be completed in. Check course prerequisites before deviating from this suggested schedule.

Year	Fall Semester	Spring Semester
1	MTH 141 Calculus I	MTH 142 Calculus II
2	MTH 241 Calculus III MTH 309 Intro Lin Algebra	MTH 306 Intro Diff Eq MTH 311 Intro Higher Math
3	MTH elective MTH/CSE elective	MTH/CSE elective
4	MTH 519 Intro Abstr Algebra MTH 531 Intro Real Var I	MTH 520 Adv Lin Algebra MTH 432 Intro Real Var II
5	Graduate electives: 6 courses including at least 12 credits in graduate mathematics courses. Included must be one year-long sequence in mathematics at the 500 level or above.	

Advising Notes:

- The third year undergraduate elective courses must be approved by the Director of Undergraduate Studies. The courses MTH 417 and MTH 495-499 are not acceptable as electives.
- The graduate elective courses must be approved by the Director of Graduate Studies.

Course	Credits	Grade	Semester
Perequisites (min 3.0 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
Required MTH courses			
MTH 311 Intro to Higher Mathematics	4		
MTH 519 Abstract Algebra	3		
MTH 520 Advanced Linear Algebra	3		
MTH 531 Intro to Real Variables I	3		
MTH 532 Intro to Real Variables II	3		
MTH Undergraduate Elective (MTH 300/400-level, not MTH 417, 495-499)			
MTH/CSE Undergraduate Electives (MTH 300/400-level, not MTH 417, 495-499)			
MTH Graduate Electives (6 courses, including 12 credits in graduate MTH courses)			

Minor in Mathematics

The minor in mathematics is open to students with any major. It may be an especially attractive option for students who are pursuing a major in a related field such as engineering, economics, natural sciences etc.

If you are interested in the minor in mathematics, please contact Patti Wieclaw, the Undergraduate Studies Secretary either in person in 233 Mathematics Building, or by phone (716) 645-8785. In most cases requests to be admitted to the minor are processed on a walk-in basis. It is recommended that you apply to the minor in mathematics at least two semesters prior to your expected graduation date.

Course	Credits	Grade	Semester
Perequisites (min 2.5 GPA)			
MTH 141 Calculus I	4		
MTH 142 Calculus II	4		
MTH 241 Calculus III	4		
Required MTH courses			
MTH 306 Intro Diff Eq	4		
MTH 309 Intro Linear Algebra	4		
MTH Electives (two MTH 300/400-level courses, not MTH 495-499)			

Advising Notes:
- STA 301 and STA 302 can be used as elective courses.
- Courses MTH 495-499 are not acceptable as electives.

From Our Alumni

Every year our graduating math majors complete exit surveys. We ask them about their experience in the program, what they liked and what they think we should improve, what were their favorite (and least favorite) classes, what they plan for the future etc. Below are excerpts from surveys collected last year.

The best part of being a math major is...
- The community was welcoming. I never felt like I was looked down upon by anyone. It felt like a comfortable environment with peers and mentors.
- I appreciated the study groups in the lounge. I learned a lot by doing my homework in there. [*Our lounge is open to all math majors - you can come to study, to have lunch, or to relax between classes*].
- I enjoyed the opportunity to be a TA and to do an internship for credit. [*See p. 10 for information on the Undergraduate TA program.*].
- Honors thesis and independent study experience. It gave me a chance to work one-on-one with a professor on a research project.
- The friends I have made in my classes. Most of the classes in the major are small and you are surrounded by the same students. Everyone has been so nice and helpful. It's like everyone understands how hard the classes are and are willing to help each other succeed.
- The math help center was a blessing when I first started out. Coming from high school I had been very poorly prepared for physics/engineering courses. It really helped me understand everything and set me up for success in later courses. [*The Math Help Center in Math Building 110 is open daily for students who need help with their coursework*].

Instructors that had the biggest impact...
- Professor Javor was the start of it all. I was his student when I took Calculus 3 and Differential Equations during my second year as a physics student. His lectures were engaging and enriching, and the amount of work he demanded from us was quite a bit. To a certain extent I can attribute becoming a mathematics major to having taken classes with him.
- Dr Cowen's introduction to higher math course expanded my mind and my ability to think and reason in a logical manner. That class specifically is responsible for much of my later success in 400 level courses.
- Rob Busch. Excellent communicator, understands the other priorities in the lives of his students but also demands high standards. Helped me to finalize my decision to become a math major.
- Dr Ringland and Adam Cunningham, with MTH448 and 337 respectively, greatly influenced my way of thinking, and gave pro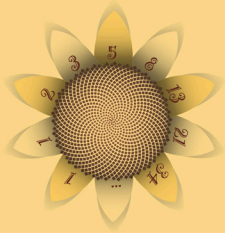jects in the coursework which encouraged me to go far beyond what was required to simply get an A in the class, and actually create something I was proud of and had worked hard on.
- Professor Hundley has helped me dozens of times, from allowing me to take an independent study with him to writing me letters of recommendation. He's always there if I need someone to throw ideas around with or just to talk to.

Advice for new math majors...
- For God's sake, no matter how "smart" you think you are, do your homework. Don't be afraid to screw up, math is hard. Ask for help if you need it. Learn how to write code. Ask about REU's. There is always free coffee in the math lounge.
- Be careful with MTH 311, because it will be probably your first proof-based course. It is different than lower level math courses.
- Take MTH 311, MTH 337 as soon as possible! These are important courses. Also, try being an undergraduate TA, applying for REUs, and approach professors to do undergraduate research! Be friends with students in the math lounge!
- Make conversation with professors and classmates, and share info.
- Like with most things, you get out what you put into it.
- Always check ratemyprofessor.com.
- Always give 100%, be involved as much as possible, and go the extra mile - you will thank yourself when you graduate.
- Get involved with clubs and programs outside your comfort zone to work towards your goals. Apply for as many internships or research programs as you can because those will help you determine what you want to do with your life post-graduation.
- Start preparing for Actuarial Exams early on as they are very competitive.
- Go to recitations. Sometimes the TA is clearer in teaching the material than the actual professor.
- Make sure your professors know who you are and meet as many people as you can. A lot of times group work is almost mandatory for difficult assignments.
- Do your HW!
- Use the help of your teachers , TAs and fellow classmates as much as possible.

Notes

3.14

JOIN UB MATH CLUB

IF YOU LIKE:

* FREE PIZZA
* GAME NIGHTS
* MATH LECTURES GIVEN BY PROFESSORS
* MATH COMPETITIONS
* HELPING THE COMMUNITY
* MAKING FRIENDS

THEN YOU'LL LOVE MATH CLUB!

for more info email us at
ubmathc@gmail.com

How to become a math major

1. Come see us

As soon as you decide that you may be interested in the math major schedule a meeting with the Director of Undergraduate Studies at the Math Department to learn about program options, requirements etc. It is never too soon to schedule this first meeting!

2. Finish prerequisites

Before you can get admitted to the math major you must complete the three-course calculus sequence: MTH 141, 142, and 241 with GPA at least 2.5. Some math concentrations have additional prerequisites - check inside this brochure for details.

3. Come see us again

The final step is to meet with the Director of Undergraduate Studies to apply for admission to the math major. At this meeting you will discuss your choice of concentration and plan your courses for the next few semesters.

To schedule an advising appointment please contact Patti Wieclaw, the Mathematics Undergraduate Secretary by phone: (716) 645-8785 or e-mail: pwieclaw@buffalo.edu.

The many paths to a math degree:

A B.S.
Actuarial Science

This program provides a curriculum for students intending to pursue a career of an actuary.

BSc B.S.
General Study in Mathematics BS

Suitable for students intending to pursue graduate study in mathematics.

BSc/AM B.S.
General Study in Applied Mathematics BS

Suitable for students intending to pursue graduate study in applied mathematics.

GS/AM B.A.
General Study in Applied Mathematics BA

For students intending to pursue graduate study in applied mathematics. Similar to BSc/AM but with fewer math electives.

GS B.A.
General Study in Mathematics BA

Suitable for students intending to pursue graduate study in mathematics. Similar to BSc but requires fewer math electives.

M/E B.A.
Joint Major in Mathematics and Economics

Joint major program with the Department of Economics.

M/P B.S.
Joint Major in Mathematical Physics

Joint major program with the Department of Physics.

GS/ED B.A.
General Study in Mathematics and Education

A program for students who plan to be mathematics teachers.

C B.A.
Computing and Applied Mathematics

A program for students interested in careers as applied mathematicians and computer programmers.

GC B.A.
General Curriculum in Mathematics

A basic liberal arts program in mathematics. Well suited to students pursuing multiple majors.

BA/MA B.A./M.A.
Combined Degree Program in Mathematics

A five year program suitable leading to the combined B.A./M.A.