The University of Montana

An Undergraduate Guide To The Study of Mathematics

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1. Introduction

Letter of Welcome

Dear Mathematics Student,

Welcome to the Department of Mathematical Sciences. This booklet, "An Undergraduate Guide to the Study of Mathematics" is designed to help you plan your studies. You will find a wealth of useful information in this guide. Read it and keep it for future reference. You can also find this information (and updated versions) on the World Wide Web at http://www.umt.edu/math/undergraduate/guide.pdf.

The Department is indebted to many faculty and alumni who have worked to make this document a useful guide. We are always looking for suggestions that would increase the value of the guide for our students.

The Department of Mathematical Sciences is a large department. We have more than 25 full-time faculty (21 tenure-track), 80 undergraduate majors, 35 minors and 25 graduate students. Approximately 2,700 students take classes in our department each semester. The Mathematics Building houses a Mathematics Learning Center and two mathematical computing laboratories. We have an excellent faculty that works very hard to help students succeed. Their expertise is varied and you can receive a strong background in several different areas: pure and applied mathematics, combinatorics & optimization, mathematics education and statistics. This guide will help you take full advantage of all the opportunities available to you while you are a student in our Department.

The Department hopes that all of its graduates will always feel at home here. We are proud of our graduates and are anxious to follow their careers. We invite you back to visit with us whenever you have a chance. Write and tell us about your jobs or graduate work. We are especially interested to hear how participation in our programs has (or has not) prepared you for what you are doing. Do keep in touch with us and make sure we always have your current address.

Leonid Kalachev, Chair
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Overview of the Undergraduate Guide

Mathematics is more than just numbers. A mathematics student uses the ability to compute, to think logically, to solve problems and to analyze. All of these qualities characterize an educated individual and are valued by employers.

The subject of mathematics has a long history, and yet is continually evolving. Mathematics gives students flexibility in career choices and is also a viable way to prepare for graduate study in several fields. For example, fields such as computer science and chemistry require a great deal of mathematical skills. Mathematics is a challenging field that opens doors to many other subjects such as the physical sciences, engineering, computer science as well as the biological and social sciences.

This guide is meant to help students learn more about getting a degree in mathematics. In this booklet you will find a list of courses needed for various options, the order in which the courses should be taken and what semesters they are offered.

The booklet also provides information about activities, facilities, financial assistance and post graduate opportunities. You are encouraged to read through this guide to get as much out of your degree in mathematics and the Department of Mathematical Sciences as you can!

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NOTE: *There are photographs of all mathematics faculty, teaching assistants and staff in the hall next to MA 105.*

2. Why Study Math?

What Can You Do with a Math Major?

Even if you do not choose a career in the mathematical sciences, studying as much mathematics as you can is a good way to keep your options open. Mathematics is an excellent foundation for, and is usually a prerequisite to, all areas of science and engineering. Students in such areas as anthropology, sociology and psychology, as well as law, business and medicine benefit from a solid background in mathematics and statistics. In addition, mathematical training will help you to better understand science and technology and their effects on our world.

Because their skills are in demand, mathematical scientists often find they can follow a number of career paths which generally pay higher salaries. As you plan your future, remember that study in the mathematical sciences can lead to an interesting, rewarding and well-paying career.

It is not merely a conjecture that jobs in the mathematical sciences (pure and applied mathematics, operations research, statistics, management science, teaching and actuarial science) are "best." According to the Jobs Rated Almanac, a 1999 publication of World Almanac Books of New York, NY, careers that require a very strong background in mathematics are listed as the five "best" jobs, namely web site manager, actuary, computer systems analyst, software engineer and mathematician.

NOTE: Some of the material in the section "What Can You Do with a Math Major?" came from Careers that Count and Mathematical Scientists at Work available in the CBMS Career Packet. See Appendix I, "Mathematical Organizations & Related Agencies," for the address to send for the packet.

List of Job Titles of UM Math Alumni

Account Executive
Account Representative
Actuarial Analyst
Airline Captain
Airport Services Agent
Analyst
Applications Engineer
Artist
Assistant Professor
Attorney
Bank Teller
Banker
Boiler Operator
Casino Dealer
Chief Deputy
Child Support Investigator
Civil Engineer
Congressman
Communications Specialist
Computer Analyst
Computer Facilitator
Computer Programmer
Computer Programming Analyst
Computer Specialist
Computer Systems Operator
Consultant
Corporate President
Data Processing Consulting
Data Processing Manager
Deacon
Dentist
Director
Editor
Electrical Engineer
Engineer
Engineer Programmer
Engineering Manager
Engineering Supervisor
Financial Manager
Geophysicist
Industrial Analyst
Instructional Designer
Lease Consultant
Leasing Agent
Librarian
Lodging Director
Medical Doctor
Magazine/Book Wholesale Distributor
Major General
Management Analyst
Marine Colonel
Mathematician
Medical Research Analyst
Meteorologist
Methods Analyst
Office/Data Processing Manager
Optometrist
Owner/President
Peace Corps Volunteer
Pilot Instructor
Principal
Principal Analyst
Principal Engineer
Procurement Manager
Product Development
Professor
Program Analyst
Property & Tax Manager
Proprietor
Regional Director
Registered Nurse
School Psychologist
Scientist
Small Business Owner
Social Worker
Software Analyst
Software Design Specialist
Software Engineer
Software Instructor
Statistical Computation Consultant

Systems Analyst	Taxpayer Service Representative	Underwriter
Systems Programmer	Teacher	Vice President & Trust Officer
Tax Preparer	Tutor	Vice Provost

Advice from Graduates of the UM Math Department

A survey was taken of students who received B.A. degrees in mathematics at UM. These graduates were asked:

"What advice would you give an undergraduate seeking a math degree?"

Here are some of their replies:

- My advice would be to explore other fields in conjunction with math, as some of the most interesting and rewarding careers are cross-discipline.
- Get some job-related experience or find an internship program before you graduate, so you have some direction before graduation arrives.
- Don't be afraid to visit with faculty, TA's, etc. Get some experience teaching math, tutor …
- Take lots of computer science as well.
- Classes in math theory are equally as important as classes in applications. There is more to mathematics than plugging numbers into formulas. To check your result from a formula you have to know the why's. The why's can give you an approximate answer, the formula -- the exact answer!
- Too many good mathematicians are poor communicators and, therefore, poor teachers.
- Learn as much as possible about different career opportunities which build on a math background.
- It's a very valuable degree to have and in considerable demand. The skills from advanced courses (for advanced degrees) are also very valuable. I have found that my math skills have allowed me the freedom to essentially create my own position.
- To have a good idea as to what (s)he wants to do with the degree, and then to make sure the curriculum and courses will fulfill that need.
- I don't have much to tell someone who arrived at college with a lot of self-confidence and is in control of his or her classes. For the people who have some math anxiety, I do know its possible to work through the problem. It is possible to succeed in mathematics.
- Get a strong emphasis in computers, information management or business information systems.
- Consider it a language to be used in another field of science. If you can attain the degree in mathematics you have a strong advantage in exploring other fields of science.
- Get a very broad education. Take classes in all areas --especially communication, working in groups, interacting with others.
- To do it, opens up unlimited possibilities in many fields. When I graduated (1975) there were 3 students who gradated in non-educational math that year. Of the three, one is an attorney, one teaches chemistry at Berkeley (UC) and I'm a dentist. I take pride in my mathematics education and the future it has provided for me. I'm also proud of UM in general.
- Be open to all the different career paths which involve a strong background in math. I wish I had known about actuarial science and some of the business applications of math such as forecasting, regression, operations research (queuing theory and scheduling) and so forth.
- Two things. First, I recommend taking lots of computer science courses, and better yet, getting a minor or second major in computer science. I also recommend pursuing any second major, since straight math jobs are difficult to find. Second, I recommend trying to get involved in an internship during undergraduate years. It's good experience and you'll make contacts for future references. I believe networking is the best method for finding a job. Also, do some independent research. Its good to put on a resume.
- Expect that your life will be much different than you are planning.
- Take lots of CS. Double major with it even if it takes an extra year.

3. Math Majors & Minors

The University of Montana offers the Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees in mathematical sciences, as well as a minor. In addition, an interdisciplinary Bachelor of Science degree in mathematics and computer science is offered.

3.A The Math Major (Including its Options)

At the undergraduate level there are five available options: applied mathematics, combinatorics & optimization, mathematics education, pure mathematics and statistics.

Students are not required to take a specific option and can acquire a mathematics degree by completing the requirements for a mathematical sciences B.A. degree discussed below. Mathematics majors, however, are encouraged to complete a specific option.

What Is The Applied Mathematics Option?

Applied mathematics refers to those topics in mathematics that are most useful for analyzing real world applications in engineering, physics, chemistry, earth sciences and biological sciences. The emphasis here is in constructing a (generally nonlinear) model of the real world application, and applying differential, integral or difference equations in arriving at a solution to the problem. Job opportunities for applied mathematicians exist in most industries as well as in the national laboratories such as Sandia, Los Alamos and Lawrence Livermore Labs. Academic opportunities exist in limited quantities for applied mathematicians with a Ph.D. degree.

At UM we specialize in biological modeling. These models include population models, natural resource models, chemical oscillations such as those that may resemble circadian rhythms, and purely biological models such as those involving the dynamics in a cell or the growth of bones. The emphasis is on learning how to solve ordinary and partial differential equations: in closed form when they are linear, and using numerical techniques when they are nonlinear. Linear algebra is an important topic, as most models require an understanding of the spectrum (eigenvalues) of the operator. Optimal control can play a role in analyzing a natural resource model: when is the optimal time to harvest the resource and what is the sustainable yield are two questions that can be asked about those situations. Such concepts as Fourier series, chaos, bursting, oscillations and steady states are important topics in this option.

What Is The Combinatorics & Optimization Option?

At The University of Montana, this research option involves the study and applications of the methods, the models and the theory of optimization. An optimization problem consists of three pieces of information:

(1) Decision Variables -- i.e., what values are you trying to decide. These variables could be discrete variables, continuous variables or random variables.

(2) Objective Function -- i.e., what quantity are you trying to maximize or minimize.

(3) Constraints -- i.e., what are the constraints on the situation.

At UM, we offer two independent semester (sophomore, junior level) courses on discrete optimization models and methods (e.g., shortest path through networks and maximal flow through a network) and on linear optimization models and methods ("linear programming"). At the senior level we have two independent semester courses. One course is on linear and non-linear optimization models, methods and theory. The other course is on stochastic optimization models (e.g., queuing models or inventory models). Some recommended background or complementary courses for an operations research option include multivariable calculus, differential equations, linear algebra, as well as probability and statistics. For further information on the Combinatorics and Optimization option emphasis contact Dr. George McRae.

The applied mathematics option requires the ability to do rigorous analysis, so this option can be chosen by students planning to do graduate work in an applied science or mathematics. Students in this option are urged to learn a computer language such as C or FORTRAN, as these are often valuable in the numerical analysis of problems. For further information on the applied mathematics option, contact Dr. Leonid Kalachev.

What Is The Mathematics Education Option?

Often students who are good in mathematics accept the challenge of developing mathematical power in others. The University of Montana mathematics program offers an option in mathematics education to train teachers of mathematics. Graduates with this option are certified to teach mathematics in grades 5 through 12 in Montana.

This option contains a broad range of mathematics courses, including number theory, geometry, statistics, mathematical structures and the history of mathematics. Students explore the use of technology as a learning and teaching tool in the mathematics classroom. The option also includes the education, psychology, teaching methods and field experiences necessary for teacher certification.

The mathematics and general components of the mathematics education option reflect the developing changes in the secondary school mathematics curriculum. Prospective teachers are required to know enough about mathematics and enough about teaching to adapt to the increasing complexity of the interactions of learners with mathematics. For further information on the mathematics education emphasis contact Dr. James Hirstein.

What Is The Pure Mathematics Option?

Students who find mathematics challenging, fascinating, beautiful or enjoyable will probably choose to study mathematics beyond the bachelor's degree. Further, most careers in mathematics require preparation beyond the bachelor's degree. If your objective is to pursue graduate study in mathematics (now or later), you will want to take the sequence of courses listed under the pure mathematics option. This option builds your ability to do rigorous mathematics in algebra and analysis. Often students are required to have completed such study before being granted admission into some graduate programs. Other graduate departments will sometimes grant admission to their programs while requiring the student to complete such a study in their first year. If you are unsure about continuing to study mathematics beyond the bachelor's degree, you will keep your options open by studying at least one of the algebra or analysis sequences.

The pure mathematics option is intended for students who are on the road toward an advanced degree in mathematics. Job opportunities for the student who completes the bachelor's degree in this option will be limited. Many students, in addition to completing the requirements of the pure mathematics option, complete the requirements in one of the applied options as well.

In general, approximately two years of study beyond the bachelor's degree is required to obtain the master's degree and another three to four years beyond that to obtain the doctor's degree (which is the terminal degree). For further information on the pure math emphasis contact Dr. Nikolaus Vonessen.

What Is The Statistics Option?

Statistics is the study of techniques for the collection, analysis, interpretation and presentation of data. Careers exist in fields from insurance to engineering, from biology to economics, from business to education; in fact, statistical concepts are used almost everywhere. Most careers in statistics require a master's degree. Undergraduate courses give a general background in the field, and more specialized courses are taught at the graduate level. For advanced work, a good knowledge of calculus, linear algebra and analysis is required. Numerical analysis and mathematical modeling are also useful. Computers are used extensively and many types of statistical packages exist. A good statistician also has good reading, writing, speaking and listening skills. The knowledge of a second discipline outside of the mathematics/statistics area shows scientific interest and flexibility in a student who wishes to pursue an industrial career. For further information on the statistics option contact Dr. Dave Patterson.

The Requirements for a Math Degree

The precise requirements for earning a degree from the University of Montana are detailed in the UM Catalog. The most important requirements are summarized in several documents in the appendix.

The Advising Guidelines summarize

- Many of the requirements for a first bachelor degree from UM, including when to apply for graduation; and
- The departmental requirements for a earning a B.A. in Mathematical Sciences.

There are also three Advising Worksheets, which spell out in detail which courses a math major has to take:

- Advising Worksheet for Mathematics Education Majors
- Advising Worksheet for the Combined Major in Math and Computer Science
- Advising Worksheet for all other Math Majors. This includes:
  - Math majors who do not declare an option
  - The applied math option
  - The combinatorics and optimization option
  - The pure math option
  - The statistics option

You should also consult the UM General Education Requirement Checklists (GRE Checklists), which are available from the Undergraduate Advising Center. Note that there are several GRE Checklists, depending on when you started studying at UM (more precisely, depending on which UM Catalog you can use to satisfy the General Education Requirements).

Advising and the Math Major Database

Each mathematics major is assigned a faculty advisor who will give advice on courses, help plan class schedules and assist in career planning. Mathematics minors are advised by the associate chair of the department. If you do not know who your advisor is, ask in the Math Office (MA 102). Every undergraduate is required to meet with his or her advisor prior to registration. You must obtain your advising number from your advisor before you can register. Although a student's advisor provides guidance on course selection, the student is still responsible for making sure he/she has all of the courses required to graduate.

A graduation application must be submitted to the Registrar's Office the semester before you plan to graduate (see the UM Class Schedule for deadlines). It must be signed by the Associate Chair of the math department. You may graduate under any catalog under which you have been enrolled during the six years prior to graduation.

The mathematics department keeps a database of all math majors which is updated every semester. Being in the database helps the department know who you are and know if you are eligible for scholarships, contests, etc. You are automatically in the database if you have declared a math major. If you have not declared a math major, change of major/minor forms are available at Griz Central (Lommasson 201); these forms must be signed by the Associate Chair of the math department. It is important to fill these major/minor forms out so that the university knows from which department you are getting your degree and so that your major department can assign you an appropriate advisor.

3.B The Combined Major in Math and Computer Science

The purpose of this major is to provide a thorough background in both Mathematics and Computer Science, and to inculcate a deeper understanding of the goals and methods of these two allied disciplines. A student must complete 60 credits in the two disciplines: 30 credits in math courses and 30 credits in computer science courses. The

detailed requirements for the combined major are in the UM Catalog, both in the Mathematical Sciences section and the Computer Science section.

The most important requirements are summarized in several documents in the appendix.

The Advising Guidelines summarize many of the requirements for a first bachelor degree from UM, including when to apply for graduation.

The Advising Worksheet for the Combined Major in Math and Computer Science spells out in detail the departmental requirements for the combined major.

You should also consult the UM General Education Requirement Checklists (GRE Checklists), which are available from the Undergraduate Advising Center. Note that there are several GRE Checklists, depending on when you started studying at UM (more precisely, depending on which UM Catalog you can use to satisfy the General Education Requirements).

Please see also the section "Advising and the Math Major Database" above. The math department strongly recommends that you meet with both your math and CS advisors each semester during the registration period.

3.C The Math Minor

There are two substantially different minors: the **mathematics minor** (math minor, for short) and the **mathematics education minor**.

The Math Minor

If you like math, it doesn't take that much extra work to earn a math minor. For some majors (e.g., computer science and physics majors), it takes **only 2 additional courses** beyond the courses required by the major!

And there are quite a few advantages:

- A math minor looks good on your resume.
- It demonstrates you know quite a bit of mathematics or statistics.
- It demonstrates that you have rigorous reasoning and problem solving skills.
- Graduate programs in the quantitative sciences like it. And so do Medical Schools and Law Schools.
- It makes you more marketable.
- But most importantly: Earning a math minor is fun. And a challenge.

If you are interested in a **Mathematics Minor**, please look at the Math Minor Handout in the appendix. It contains a description of the requirements, including quite a few suggested curricula.

The Mathematics Education Minor

This is a teaching minor for students who plan to be certified as secondary teachers. The precise requirements are specified in the UM Catalog. From the 2007-2008 Catalog:

For a teaching minor endorsement in the field of mathematics, a student must complete MATH 152-153, 221, 301, 305, 326, 341, and 431. Students also must complete C&I 430, gain admission to Teacher Education and Student Teaching and meet the requirements for certification as a secondary teacher (see the School of Education section of this catalog). All courses counted toward the minor must be passed with a letter grade of C- or better and a 2.00 grade average is required.

4. Course Offerings

Planning Ahead

It is important for undergraduates to understand that many courses are *not* offered every semester and some courses are offered alternate years. Be aware of this when planning your program! Year-long sequences are often available only on a basis of one course per semester throughout the academic year; therefore, you need to enter the sequence in the fall semester. Plan your schedule very carefully so that you do not miss a course you need because it is not offered the semester or year you preferred to take it.

Usual Course Offerings

The following classes are offered every Fall and Spring semester:

M	121	122	151	171	172	221	273	300	307	STAT 341
Math	111	112	121	152	153	221	251	300	305	MATH 341

Fall Semester Only	Spring Semester Only
M 225 (MATH 225)	—
—	M 274 (MATH 158)
M 301 (MATH 301)	—
M 311 (MATH 311)	M 412 (MATH 412)
—	M 326 (MATH 326)
M 362 (MATH 382)	M 361 (MATH 381)
M 381* (MATH 351)	—
M 414 (MATH 414)	—
—	M 429 (MATH 406)
M 431 (MATH 421)	M 432 (MATH 422)
M 439 (MATH 431)	—
—	M 440* (MATH 471)
M 445* (MATH 475)	
M 473* (MATH 451)	M 472 (MATH 452)
M 485(MATH 485)	—
STAT 421 (MATH 441)	STAT 422 (MATH 442)
STAT 451 (MATH 444)	STAT 452 (MATH 445)

*These courses are offered every other year, or intermittently. The semester in which they are taught may be fall or spring, but usually is the semester which is indicated.

5. Activities & Facilities of the Math Department

Math Club

The Math Club at The University of Montana is comprised of students who are interested in mathematics. The club meets each Tuesday afternoon at 3pm (in Math 103) for the undergraduate mathematics seminar. Attending these seminars is a great way to learn about various areas of mathematics, become acquainted with professors, encounter a few things you might not see in your traditional course work, and provide a broader background in mathematics. Two favorite themes of last year's lectures were "What is …?" and " Ask an Alum". The seminar series also includes lectures on careers, culture and popularization of mathematics. Every member of the Math Club is also a member of the student chapter of the Mathematical Association of America (MAA); as a member you receive a subscription to the math magazine, Horizons.

The Math Club sponsors several events each year—Gambling Day, Pi Day and a film festival. During Gambling Day we play various games of chance including black jack, craps and Texas hold 'em—with Math Club money—and learn the mathematics behind them. The math film festival is held each year during Math Awareness Month. The films are typically chosen to complement the theme of national Math Awareness Month. Can you guess the date of Pi Day?

The University of Montana Math Club is a combination of the Mathematical Association of America UM Chapter and the Pi Mu Epsilon Chapter (a mathematics honorary society). (Information concerning MAA immediately follows. Information for Pi Mu Epsilon follows in Section 6.) Undergraduates are strongly encouraged to participate in the meetings whether a member of one of these organizations or not. For more information see www.math.umt.edu/mathclub or contact the faculty advisor Nikolaus Vonessen (MA 210, 243-6222).

Undergraduate Seminar

The Undergraduate Math Seminar meets on Tuesday afternoon at 3 pm in Math 103. The club is intended for students who are interested in mathematics. You can register for Math Club Seminar (M 300) for 1 credit, or you can simply attend whenever possible.

The weekly seminar series gives student the opportunity to explore various areas of mathematics that might not otherwise be encountered in traditional coursework. The seminars provide students with a broader background in their discipline and acquaint them with a variety of professors, alumni and other professional. Two favorite themes of last year's lectures were "What is …?" and "Ask an Alum". The seminar series also includes lectures on careers, culture and popularization of mathematics. Past presenters have included representatives of the US Forest Service, the National Council of Teachers of Mathematics, and UM Career Counseling. For international week, we celebrated with a discussion of math of other cultures and a sampling of international food! Each semester the club also selects and reads a popular book on mathematics. Past favorites include *Zero: The Biography of a Dangerous Idea*, by Charles Seife and *In Code: A Mathematical Journey,* by Sarah Flannery.

Mathematics Association of America UM Chapter

The Mathematical Association of America (MAA) is a national organization of mathematicians. The MAA student chapter program was launched in January 1989 to encourage students to continue study in the mathematical sciences, enable them to meet with other students interested in mathematics, provide an opportunity for students to interact with prominent mathematicians at national meetings and provide information about careers in the mathematical sciences.

Students wishing to become a member of the MAA can complete an application on-line. Student members need not be mathematics majors, nor do they need to have a particular class standing or grade point average. The program seeks to "offer all students interested in exploring mathematics outside of the regular classroom a chance to

challenge their intellect and learn more about the role of mathematics in our world." Every student member of the MAA receives a copy of "Math Horizons" magazine and the MAA's newsletter, FOCUS. Math Horizons is a magazine written primarily for undergraduate students, with the purpose of introducing students to the world of mathematics outside the classroom. Each issue centering a variety of articles as well as a problem session and book reviews. (See www.maa.org/mathhorizons/ for more details.) There are three other publications that a MAA member may receive; The College Mathematics Journal, Mathematics Magazine or The American Mathematical Monthly.

In addition to receiving their choice of journals, students will receive discounts on meeting registration fees and other MAA publications, information on graduate study and career opportunities, information about speakers, and opportunities to participate in student paper sessions at section meetings. For more information see http://www.maa.org/students/. We encourage student chapter members to join in the fall. Members whose applications are received in October or November will begin membership benefits immediately and throughout the following year. Members whose applications are received in the first half of the year will be sent all back journal issues to the beginning of the year. Students wishing to join must fill out the student chapter membership application renewal form available on-line or from the faculty advisor, Professor Jenny McNulty (MA 7C, 243-2473).

Undergraduate Study Lounge & Information Board

Undergraduate Study Lounge

One of the facilities offered to undergraduates in the math building is the undergraduate study lounge in MA 212. This room is set aside as a study area for undergraduates and has many algebra and calculus textbooks one can use for reference. In addition, large tables are available for group study. This is an ideal place to meet with fellow students to work on assignments and have close accessibility to computer labs as well as professors' offices during office hours. Students find that the study lounge is a convenient place to study between classes. With group studying, the noise levels can occasionally get loud, but more often it is a quiet study environment.

Undergraduate Information Board

Also available in MA 212 is the undergraduate information board. Information about scholarships, internships, department job openings and general math information is posted on this board. Math magazines, journals and newsletters are displayed here as well. Math majors should check this board periodically for departmental information that could effect them

Computing Facilities

The mathematics department operates two PC computer labs, the PC lab in MA 206 and MA 306. These labs are for students to use for math-related work. Some of the software currently on the department's network include: Data Desk, Geometer's Sketchpad, Graphing Calculator, Gino, Lindo, Maple, Mathematica, MATLAB, Microsoft Office, S-Plus, SPSS, and Scientific Workplace. Tools for communicating with other computers include Fetch, NCSA Telnet, and Netscape. Through other computers there is access to compilers for languages such as COBOL, ADA, FORTRAN and C.

In order to access the lab, an undergraduate must have a special ID card. The card must be presented to the lab monitor upon entering the lab. ID cards are available to students in particular classes or on the recommendation of a professor. For a list of operating policies see Appendix IV, "Computer Labs Operating Policy." A lab schedule is posted each semester.

The Computing & Information Services (LA 002 -- 243-5455) also operates several PC and Macintosh labs around campus that are open evenings and weekends when the math department labs are closed.

Senior Projects &Watkins Scholars

Senior Thesis

An excellent addition, and an asset to ones education, is the completion of a senior thesis. Employers and graduate schools alike seek students who have had research experience. Students who plan to write a senior thesis should select a research topic during their junior year. Do this by approaching a professor whom you would like to work with and asking them for suggestions of possible research topics. Also, a one credit independent honors project seminar (M 392) is offered to help juniors explore and write a senior thesis proposal. The credits (typically 3 per semester) earned in an independent study course do not count towards credit in one's major, thus you will not go over the credit cap in your major (see "General Requirements for a Math Degree," p. 14, in Chapter 3). Completed senior projects are written up, bound, and presented to the advisor.

Watkins Scholars

Each year the Davidson Honors College offers up to 10 Watkins scholarships to fund a senior project. Each recipient receives a stipend of $1,500 payable over two semesters. Students with a GPA of 3.4 or higher who have senior status are eligible to apply. The student must either have a major or minor in the College of Arts and Sciences or submit a project which will be directed by a College of Arts and Sciences faculty member for credit in that faculty member's department. Applications for the scholarship must include transcripts, a letter of support from your faculty advisor, a prospectus of about five pages giving a description of your project and a one-page abstract of your proposal. All of this is due no later than March 1st.

For more information on Watkins scholarships see Dr. George McRae (MA 310, 243-2502) or contact the Davidson Honors College.

Selected Senior Thesis Projects -- Mathematics

Year	Student	Project Title Advisor
2000-01	Scott Jones (Watkins)	George McRae
1999-00	James McCreight (Watkins)	Leibniz's Calculus of Infinitesimals Revisited George McRae
1997-98	Catherine Murray (Watkins)	George McRae
1995-96	Ruth Burgad (Watkins)	Grant Tracking: A Feasibility Study and Development Proposal Ray Ford & George McRae
1994-95	Deborah Haubrich (Watkins)	Confronting the Frontier of Mathematics: A Creative Approach to Graph Embeddings Jenny McNulty & George McRae
	Charlotte Hilton (Watkins)	Best Smoothing Technique for Geographic Information Hans Zuuring & George McRae
	Hung Quan (Watkins)	A Model for the Biological Control of Spotted Knapweed Bill Derrick
	Brett Loomis	Dynamic Complexity in a System of Difference Equations Bill Derrick
1993-94	Amy Haas (Watkins)	The Simplex Algorithm for Linear Optimization George McRae
	Brian Hatfield (Watkins)	Genetics and Conservation of Rocky Mountain Big Horn Sheep Fred Allendof & Gordon Luikart
1992-93	Douglas Holstein (Watkins)	Finiteness Conditions in Abstract Algebra George McRae
	Patricia Olson (Watkins)	Optimal Strategy in Jury Selection David Patterson & George McRae
	Larry Risinger	Generalizing Rings of Continuous Functions to Countable

	(Watkins)	Coherent Rings George McRae
	Diana Thomas (Watkins)	A Mathematical Study of Fluid Flow and Turbulence Bill Derrick & George McRae
1990-91	Eric Maki (Watkins)	A Study of Prepositional Logic and Artificial Intelligence Keith Yale & George McRae
1989-90	Cheryl Hinze	The Relationship Between National Fire anger Rating System Indexes and Fire Occurrences Don Loftsgaarden
	Loreen McRae (Watkins)	Predicting Large Forest Fires with Logistic Regression Don Loftsgaarden
	Eric Schneider (Watkins)	Logic and Deductive Reasoning George McRae
1988-89	Josef Crepeau (Watkins)	A Computer Graphics Illustrations of Karmarkar's Algorithm for Linear Programming John Sallee
	Douglas Galarus (Watkins)	A Study of the Traveling Salesman Problem George McRae
1987-88	Glenyss Ammons (Watkins)	A Study of Set Theory and Axiom of Regularity Merle Manis
	Don Gilmore (Watkins)	Transformations for High School Geometry Johnny Lott
	Curtis Schuhmacher (Watkins)	Using Modern Math to Design an Intelligent Data Base George McRae
	John States (Watkins)	Evaluation of Computer Software to Teach Mathematics Johnny Lott
	Jim Veroulis (Watkins)	An Analysis of Karmarkar's Algorithm John Sallee & George McRae

Modeling Contest, Putnam Exam, Lennes Exam

Modeling Contest

The Mathematical Contest in Modeling (MCM), a national contest for college undergraduates, is held every February. The MCM is designed to stimulate and improve problem-solving and writing skills in a team setting. At UM, Dr. George McRae (MA 310, 243-2502) is the advisor in charge of organizing teams for the event. Each department may enter one or two teams of three members each. This contests starts on a Friday morning at 12:01 am and continues through the weekend (usually the third weekend in February). Each team is given two problems of which they choose one to solve. Once a problem is chosen and work begins, the team may only discuss aspects of the problem among themselves. The contestants may draw upon any resources they can find except persons who can supply them with information reflecting professional expertise. The solution must be typed in English and postmarked no later than five o'clock at the end of the weekend (sometimes a three-day weekend). Judging takes place three weeks after the contest. Top solutions will be recognized as Honorable Mention, Meritorious or Outstanding. The 1994 UM team received an Honorable Mention. All successful participants will receive a certificate. Outstanding teams will receive bronze plaques and their solution papers will be published in the contests publication entitled *The UMAP Journal*. To participate, you are encouraged to enroll in the Problems and Contests Seminar (M 394) offered each semester. This seminar looks at old Modeling Contest problems and uses them for practice.

Putnam Exam

The William Lowell Putnam Mathematical Competition is a competitive examination in collegiate mathematics sponsored by the Mathematical Association of America. This examination is usually held the first weekend of

December. The competition is open only to regularly enrolled undergraduates in colleges and universities of the United States and Canada who have not yet received a college degree. No individual may participate in the competition more than four times.

A college or university with at least three registered entrants obtains a team rank through the positions achieved by three designated contestants. The examination consists of two periods of exactly three hours each with a two hour break between the two sessions. The examination is administered under the official supervision of the department of mathematics at the institution. Any college or university desiring to compete must complete and return registration material to meet a deadline which occurs in mid-October.

Each problem is graded on a basis of 0 to 10 points. All work done to justify an answer and all the necessary steps of a proof mush be shown clearly to obtain full credit. Some partial credit may be given, but only when a contestant has shown significant and substantial progress toward a solution.

Prizes are awarded to the mathematics departments of the institutions for each of the five winning teams. The five highest ranking individuals are designated Putnam Fellows by the Mathematical Association of America. Prizes will be awarded to each of these individuals and to each of the next twenty highest ranking contestants.

If you have any questions about the Putnam Exam or would like to participate, contact Dick Lane (MA 203, 243-5207). Also, you are encouraged to enroll in the Problems and Contests Seminar (MA 394) offered each term. Old Putnam Exam problems are examined in this seminar and used to practice for the next exam.

Lennes Exam

See "Scholarships" in Section 6.

Working for the Mathematics Department

The math department hires undergraduates for several types of positions. These include grading, tutoring and monitoring the computer labs. Information about each job follows. Inquire in the math office for more information or for applications.

Computer Lab Monitor

There are two computer labs in the math building (MA 206 and MA 306). The math department hires students to monitor these labs to make sure the appropriate people are using the labs and to answer minor questions. Applications are taken at the beginning of each semester if positions are open.

Grader

Graders assist professors in the grading of homework and/or tests. Graders are usually asked to be graders in courses in which they have performed well.

Mathematics Learning Center Assistant

Assistants are hired by Emily Haverhals (MA 4E, 243-4103) to staff the Mathematics Learning Center. The center is located in the basement of the mathematics building in room MA 11 and is open Monday through Friday from 8AM to 5PM. The center provides free walk in assistance to students in all developmental and first year mathematics courses: Introductory Algebra through Calculus II. Applications are taken for employment starting in April of each year for the following academic year.

Private Tutoring

If you wish to tutor for any math course, you can put your name, number and hourly charge on a tutor list that is available on the math department website. This tutor list is provided to students seeking a tutor for a math class.

6. Scholarships, Honors & Awards

Internships & Research Experiences

Internships

Often employers desire their employees to have prior work experience. An excellent way to get work experience is through internships. Internships also give students the opportunity to learn more about a particular field, job or area. The cooperative education department in ELC 154 can help you find an internship, whether the internship is for the summer or school year. It is often possible to find internships both locally and out of the area.

Research Experiences

Another option for internships is Research Experiences for Undergraduates (REUs). Several colleges and universities across the US receive funding by the National Science Foundation (NSF) to serve as REU sites. Undergraduates (usually juniors) conduct research in mathematics under the direction of faculty members at these institutions. The internships are primarily offered in the summer and usually include a stipend, travel money, as well as room and board. REUs give experience in research which is useful if you are planning to pursue an advanced degree in mathematics. A list of REU sites is available every January. This list is posted on the undergraduate information board (MA 212) and can be found on the NSF World Wide Web site at **http://www.nsf.gov** under "Special Programs: Students" within the site map. A list of 1999 REU sites can be found in Appendix II of this guidebook.

A similar type of internship is the SERS (Science and Engineering Research Semester) which is conducted by the Department of Energy (DOE). The SERS program provides students with the opportunity to participate in research at one of the seven DOE laboratories (Argonne, Brookhaven, Lawrence Berkley, Lawrence Livermore, Los Alamos, Oak Ridge and Pacific Northwest). SERS program participants become actively involved in on-going laboratory research using state-of-the-art facilities and equipment. Again, you will gain the type of experience that can be an important factor for admittance to graduate school or for future employment. To apply for a SERS internship, send for an application at the address for the Science and Engineering Research Semester located in Appendix I, "Mathematical Organizations & Related Agencies," p. iii. For more information about internships, REUs or SERS see Dr. George McRae (MA 310, 243-2502).

Pi Mu Epsilon
(National Mathematics Honor Society)

Pi Mu Epsilon is an organization whose purpose is the promotion of scholarly activities in mathematics among students and faculty in academic institutions and among the staffs of qualified non-academic institutions. It aims to do this by:

1) electing members on an honorary basis according to their proficiency in mathematics,
2) engaging in activities designed to promote the mathematical and scholarly development of its members, and
3) taking any other measures that will further the purpose stated above.

The University of Montana chapter of Pi Mu Epsilon (Montana Alpha) was established in 1925 and was the 9th chapter ever to be established. Montana Alpha was the first chapter in Montana and also the first chapter established in the West! Members of Pi Mu Epsilon are entitled to wear the purple and gold honor cords at graduation.

A person meeting any *one* of the following five sets of qualifications may be elected to membership by a chapter.

1) Undergraduate students who have had at least two years of college mathematics including calculus, who have completed their mathematical work with honor (at least B average), and who are in the top one-third of their class in their general college work.
2) Sophomores who are majoring or intend to major in mathematics, who have completed at least three semesters of college mathematics including one year of calculus, who have achieved a straight A record in

all mathematics courses taken, and who are in the top quarter of their class in their general college work.
3) Graduate students whose mathematical work is at least equivalent to that required of qualified undergraduates, and who have maintained at least a B average in mathematics during their last school year prior to their election.
4) Members of the faculty in mathematics or related subjects.
5) Any persons who have achieved distinction in a mathematical science.

Qualified students of The University of Montana are sent an invitation to join in spring semester of every year and are inducted during the Department's Awards Ceremony. For more information see www.pme-math.org or contact Professor Jenny McNulty (MA 7C, 243-2473).

Scholarships

The Department of Mathematical Sciences has a number of scholarships and awards available to undergraduates. These are primarily funded through three endowments; the George and Dorothy Bryan Endowment, the Mac Johnson Family Endowment and the Joseph Hashiasaki Memorial Scholarship Fund. Scholarships are awarded in April of each year. Applications can be picked up at the Math Office (MA 102) starting in late February and are due in late March. Scholarships and awards offered by the department are:

Joseph Hashisaki Memorial Scholarship

The Joseph Hashisaki Memorial Scholarship (one award for $1,000) is given annually to one or two outstanding upper division mathematics majors. The award is named in honor of Joe Hashisaki, a member of department from 1953-1962. He, along with John A. Peterson, published *Theory of Arithmetic* in the 1960's, the first mathematics textbook specifically for prospective elementary teachers. The money for this award comes from the Joseph Hashisaki Memorial Scholarship Fund.

Mac Johnson Family Scholarships

The Mac Johnson Family Scholarships are given annually to math majors who will be an undergraduate the following year and have shown exceptional talent in mathematics. Several $750 scholarships are named in honor of the Mac Johnson family who gave the endowment to fund these scholarships. Mac Johnson earned both a bachelor's and master's degree from The University of Montana and taught mathematics at Cut Bank High School and Northern Montana College. His wife Virginia also attended The University of Montana.

Undergraduate Mathematics Scholars Program

The purpose of the Undergraduate Mathematics Scholars Program is to make math students a crucial part of the learning environment and to increase their interest, excitement and confidence about studying mathematics. To this end, three different types of scholarships are offered under this program. An **Undergraduate Teaching Scholar** ($1,500/semester or $3,000/year) works closely with a faculty member assisting with and developing classroom activities for a math course (usually 152 or above). An **Undergraduate Tutorial Scholar** ($1,250/semester or $2,500/year) works with a faculty member to help students in a lower division course (usually 100 or 200 level). An **Undergraduate Technical Scholar** ($2,500/year) works with a faculty member in developing computer and other electronic materials, such as web pages and computer lab exercises for a course. Several scholarships are available; scholarships may be split to provide one-semester support for more students. Not every type of scholarship is awarded every year. This program is supported principally by the George and Dorothy Bryan Endowment.

John A. Peterson Mathematics Education Award

The John A. Peterson Mathematics Education Award is a book award given annually to a graduating senior with a major in mathematics education. The award is named in honor of John A. Peterson, a member of the Department of Mathematics and Computer Sciences from 1955 to 1973. He, along with Joseph Hashisaki, published *Theory of Arithmetic* in the 1960's, the first mathematics textbook specifically for prospective elementary teachers. The winner must be an outstanding student in mathematics education and a graduating Senior.

N. J. Lennes Exam

The N. J. Lennes Exam is a competitive examination given annually by the Department of Mathematical Sciences.

The exam is named in honor of Professor Nels Johann Lennes, who was chairman of the department from 1913-1944. N. J. Lennes wrote numerous mathematics textbooks. He built the house that is currently the home of the president of The University of Montana. The Lennes Exam is administered by the department's awards committee. Zero, one, two, three or more prizes may be awarded at the discretion of the judges. Awards are typically in the $50-$200 range. The exam may be taken by any UM student, mathematics major or not, who has not taken any 400 level mathematics courses. Students who have taken one year of calculus are encouraged to take the exam.

7. Post Graduate Opportunities

General Information

The following pamphlets contain useful information about careers for mathematics majors. Some are available for you to read in the undergraduate reading room (MA 212). Addresses of the mathematical organizations listed below appear in Appendix I, "Mathematical Organizations & Related Agencies." Contact these organizations directly to obtain your own copy. Several of the pamphlets are available free of charge.

- *Career Information in the Mathematical Sciences*, Conference Board of the Mathematical Sciences.
- *Actuaries Make a Difference*, 1994, The Society of Actuaries and the Casualty Actuarial Society.
- *Careers in Statistics*, The American Statistical Association.
- *Women in Statistics*, The American Statistical Association.
- *Careers in Mathematics*, 1987, American Mathematical Society.
- *The Actuarial Profession*, 1991, The Casualty Actuarial Society and The Society of Actuaries.
- *Profiles in Applied Mathematics*, 1982, Society for Industrial and Applied Mathematics.
- *Careers in Applied Mathematics*, 1982, Society for Industrial and Applied Mathematics.
- *Computer and Mathematics-Related Occupations*, 1986, US Department of Labor, Bureau of Labor Statistics.
- *Professional Opportunities in the Mathematical Sciences*, 1983, Mathematical Association of America.
- *Seeking Employment in the Mathematical Sciences*, 1985, American Mathematical Society.
- *Careers in the Mathematical Sciences*, 1988, Mathematical Association of America.
- *Careers in Operations Research*, 1990, The Operations Research Society of America.
- *Careers That Count*, 1991, Association for Women in Mathematics.
- *Mathematical Scientists at Work*, 2nd edition, Mathematical Association of America, 1991.
- *Math Horizons*, four issues per year, Mathematical Association of America.
- *Assistantships and Graduate Fellowships in the Mathematical Sciences*, one issue per year, American Mathematical Society.

Actuarial Science

Mathematicians apply their skills in many fields, one of which is actuarial science. Actuaries work for insurance companies or government agencies assessing risks and solving financial problems. An actuary's job may include placing a price on a company about to merge with another business, estimating the impact of seat belt laws in automobile losses and determining appropriate rate discounts, determining why malpractice insurance costs for doctors are skyrocketing, collecting and investing enough money so that an insurance company can pay claims, estimating the cost of a major earthquake, determining premium rates for different insurance risks and much more. Actuaries are hired by insurance companies, consulting firms and many big businesses. Mathematics majors, especially those with a statistics emphasis, are good candidates to excel as actuaries (see Appendix III, "Emphasis Worksheets," p. xiii, for statistics emphasis requirements). To become an actuary, there are a series of examinations to take administered by the Society of Actuaries and the Casualty Actuarial Society. These exams are taken throughout one's career as an actuary and are a large part of one's job. The first exam covers undergraduate subjects in calculus, linear algebra and probability. Many students complete this exam while still in college. The exams are given in November and May of each year. The corresponding registration deadlines are in October 1st and April 1st. Exam 1 costs approximately $75. The nearest testing centers are Bozeman and Spokane Applications are available at the Society of Actuaries' web site: http://www.soa.org.

For more information on careers in actuarial science or the actuary exams, contact Dr. David Patterson (MA 208, 243-6748). See Appendix I, "Mathematical Organizations & Related Agencies," for the addresses of various actuary organizations.

Teaching

Many mathematics graduates choose to pursue a career as a secondary teacher. As math literacy is becoming increasingly important in the work force, so to is the need for capable math teachers. Math teachers today are responsible for helping students understand mathematics as a tool for understanding the world.

Educators are discovering that advances in technology are bringing about a challenging and exciting era especially for math teachers. Indeed, there have recently been two large educational grants at The University of Montana, the Six Through Eight Mathematics (STEM) project and the Systemic Initiative for Montana Mathematics and Science (SIMMS) project. The goal of these projects is to analyze and reform the secondary mathematics curriculum in order to increase students' ability to explore, conjecture, and reason logically.

Besides the usual teaching jobs, there are also a variety of opportunities to teach mathematics in a nontraditional setting. For example, the Peace Corps provides opportunities for math majors to share their skills and energies with people in developing countries. Often volunteers teach mathematics, an option in which a teaching certificate is not required. Most former Peach Corps volunteers have valued the opportunity to put their skills to work. To obtain more information about the Peace Corps, write to the address found in Appendix I, "Mathematical Organizations & Related Agencies."

Business, Industry & Government

There are numerous opportunities in business, industry and government for mathematics majors. Many math majors will find employment in one of these areas. A "List of Job Titles of UM Math Alumni," in Section 2 of this guide, lists jobs currently held by UM math graduates. The wide range of occupations listed should convince you of the value and versatility of mathematical training. Often employers find mathematics majors bright and flexible and hire them for positions that may involve considerable training on the job, even though the position requires very little formal or direct mathematics education. These employers hire mathematics types because of their general background in problem solving and incisive reasoning abilities rather than mathematical knowledge.

The following information highlights a few fields in business, industry and government that employ math majors:

- Operations research analysts are often employed by manufacturing plants, airline industries, and the military to help coordinate and operate the running of these organizations in the most efficient manner.
- Statisticians are employed by business, industry and government in a wide variety of areas. They use statistical techniques to analyze data from scientific experiments, to conduct surveys, and to develop quality control tests in developing a new product.
- Applied mathematicians solve practical problems in business, government, engineering and the sciences using mathematical modeling and computational techniques.
- The National Security Agency hires mathematicians to be cryptologists. This job involves the development and analysis of coding schemes for the transmission of classified material.

The pamphlets mentioned in "General Information," p. 34 in Chapter 7, have a great deal more information about employment in business, industry and government. Many mathematicians find interesting and very satisfying careers in these work arenas.

Graduate Schools & Graduate Record Exams

Graduate Schools

There are several math-related disciplines that you can study at the graduate level after obtaining an undergraduate degree in mathematics. Students who acquire a graduate degree of some form generally obtain careers that pay higher salaries.

Mathematics is used extensively in fields such as computer science, economics, engineering and even law or medicine. Many jobs in mathematics are now requiring degrees beyond a Bachelor of Arts degree. A student

preparing for graduate school should consult an academic advisor to discuss such factors as ability, fields of interest and schools with strong programs in those fields.

Graduate education can often be financed with a teaching or research assistantship or a fellowship. A good source of information about graduate programs in mathematics at individual schools is the publication, *Assistantships and Graduate Fellowships in the Mathematical Sciences,* published annually (in December) by the American Mathematical Society (see Appendix I, "Mathematical Organizations & Related Agencies," for the address of the AMS). The booklet contains data about faculty, enrollment, facilities, as well as information about fellowships and teaching assistantships and programs of study available at universities that offer graduate degrees in the mathematical sciences.

Degrees earned in graduate school are usually Master of Arts, Master of Science, Master of Teaching, and Doctor of Philosophy. A master's degree will take anywhere from 2 to 3 years to complete, while a Ph.D. could take 5 to 7 years.

Information on graduate schools can be obtained from a variety of sources. Several local sources include the *Peterson's Guide* which can be found in the library. The bulletin boards in the hallways on the second floor of the mathematics building have information on graduate schools as well. There is a folder in MA 205 which contains the overflow from these bulletin boards.

- Application deadlines start as early as January or February.
- Applications to graduate schools often require the following:
  - Completed application form,
  - Official transcript(s),
  - Three letters of recommendation
  - Scores for the General Aptitude Test (GRE described later),
  - Non-refundable application fee of $45.00,
  - Bachelor's degree completed by the time of enrollment.

Graduate Record Exam

Before being admitted into graduate school, you will have to take the Graduate Record Examination (GRE). This exam is similar to the SAT or ACT taken for admission into college. There are two types of GRE tests, general and subject. The general test is taken by every student in any major who plans to go to graduate school. The subject test is specific to your major or particular subject. For example, there is a subject test in mathematics. Most universities will require your general GRE scores for admission to their graduate program. Many schools also require a subject test. It is suggested that this test be taken during the fall of your senior year while the material is still fresh in your mind.

The GRE tests are offered four times a year, usually in October, December, April and June. Deadlines for registration are usually a month or two prior to the exam, so be sure to check deadlines. Note that on the final date in June, only the general test is offered and no subject tests. Since graduate programs often have deadlines as early as January or February, the GRE exams should be taken in October or December of your senior year. The tests are about 3 hours long. The general tests are offered in the mornings while the subject tests are offered in the afternoon. One can take both tests on the same date, but it is also acceptable to take the tests on two different dates (some feel that 6 hours of testing in one day is a little much).

Study aides are available in many book stores or from the Educational Testing Service with whom you register. It is important to study for these examinations so you will be comfortable with the test formats and types of questions. Each test costs approximately $96. Information and application forms are available at UM Testing Services, Lommasson 154.

Career Services

If you are concerned about getting a job when you graduate from college, you may consider visiting The University of Montana Career Services Center, located in the Lommasson 154 (243-2022). It is open year-round Monday-

Friday, 7 am to 5 pm. A number of services are offered, such as career counseling, computerized career planning, on-campus employment interviews, a job vacancy reading room, salary information, career workshops, summer/part-time employment information, a professional file mailing service, career fairs and the ASK AN ALUM program. Get started early in your college years to plan for a future career. The career services can be a big help and might make a difference in finding a job soon after you graduate.

8. Appendices

I. Mathematical Organizations & Related Agencies

1. American Mathematical Society (AMS)
   PO Box 6248
   Providence, RI 02940
   (800) 321-4267
   (401) 331-3842 (fax)
   ams@ams.org *or* http://www.ams.org/

2. The American Statistical Association (ASA)
   1429 Duke Street
   Alexandria, VA 22314-3402
   (703) 684-1221
   (703) 684-2036 (fax)
   asainfo@ amstat.org *or*
   http://www.amstat.org/

3. The Association for Women in Mathematics (AWM)
   4114 Computer & Space Sciences Building
   University of Maryland
   College Park, MD 20742-2461
   (301) 405-7892
   awm@math.umd.edu

4. Commission on Professionals in Science & Technology
   1500 Massachusetts Avenue, NW, Suite 831
   Washington, DC 20005
   (202) 223-6995
   (202) 223-6444 (fax)

5. Conference Board of the Mathematical Sciences (CBMS)
   1529 Eighteenth Street, NW
   Washington, DC 20036
   (202) 293-1170

6. Council on Undergraduate Research
   Mathematical & Computer Science Division
   University of North Carolina at Asheville
   One University Heights
   Ashenville, NC 28804-3299
   (704) 251-6006

7. Industrial Mathematics Society
   PO Box 159
   Roseville, MI 48066
   (313) 771-0403

8. The Institute of Management Science (TIMS)
   290 Westminster Street
   Providence, RI 02903

9. Kappa Mu Epsilon
   National Mathematics Honor Society
   Department of Mathematics
   Niagara University
   Niagara University, NY 14109

10. The Mathematical Association of America (MAA)
    1529 Eighteenth Street, NW
    Washington DC 20036
    (800) 331-1622 (member services)
    (202) 387-5200
    (202) 265-2384 (fax)
    maahq@maa.org *or* http://www.maa.org/

11. National Association of Mathematicians (NAM)
    Elizabeth City State University
    Box 959
    Elizabeth City, NC 27909
    (919) 335-3326
    (919) 335-7408 or 335-3487 (fax)
    nam@ecsuax.uncecs.edu

12. National Council of Teachers of Mathematics (NCTM)
    1906 Association Drive
    Reston, VA 22091-1593
    (703) 620-9840
    http://www.nctm.org/

13. National Science Foundation (NSF)
    4201 Wilson Boulevard
    Arlington, VA 22230
    (703) 306-1234
    (703) 306-0202 (fax)
    first stop@nsf.gov *or* http://www.nsf.gov/

14. Operations Research Society of America (ORSA)
    Business Office
    1314 Guilford Avenue
    Baltimore, MD 21202
    (800) 887-ORSA

(410) 361-8044 (fax)
out_cmm@jhuvms.bitnet

15. Peace Corps of the United States of America
Box 941
Washington, DC 20526

16. Pi Mu Epsilon, Inc.
National Mathematics Honorary Society
Department of Mathematics
East Carolina University
Greenville, NC 27858
(919) 757-6414

17. Rocky Mountain Mathematics Consortium (RMMC)
Arizona State University
Box 871904
Tempe, AZ 85287-1904
(602) 965-3788

18. Science & Engineering Research Semester (SERS)
PO Box 23575
Washington, DC 20026-3575

19. Society for Industrial and Applied Mathematics (SIAM)
3600 University City Science Center
Philadelphia, PA 19104-2688
http://www.siam.org
student page: http://www.siam.org/students/

20. Society of Actuaries & the Casualty Actuarial Society
475 North Martingale Road
Schaumburg, IL 60173-2226
(847) 706-3500
(847) 706-3599 (fax)
http://www.soa.org/

21. Society of Women Engineers
345 East 47th Street
New York, NY 10017

22. U.S. Department of Labor
Publications Sales Center
PO Box 2145
Chicago, IL 60690

II. Research Experiences for Undergraduates (REU) National Science Foundation (NSF)

The National Science Foundation (NSF) funds a large number of research opportunities for undergraduate students through its Research Experiences for Undergraduates (REU) program. An REU Site consists of a group of ten or so undergraduates who work in the research programs of the host institution. Each student is associated with a specific research project, where he/she works closely with the faculty and other researchers. Students are granted stipends and, in many cases, assistance with housing and travel. Undergraduate students supported with NSF funds must be citizens or permanent residents of the United States or its possessions. An REU Site may be at either a US or foreign location.

By using the web page, Search for an REU Site (http://www.nsf.gov/crssprgm/reu/reu_search.cfm), you may examine opportunities in the subject areas supported by various NSF units. Also, you may search by keywords to identify sites in particular research areas or with certain features, such as a particular location.

Students must contact the individual sites for information and application materials. NSF does not have application materials and does not select student participants. A contact person and contact information is listed for each site.

(This information was taken from the NSF web site in October 2005; you may find more up-to-date information at http://www.nsf.gov/crssprgm/reu/.)

The University of Montana – Department of Mathematical Sciences

Advising Worksheet (2008-2009 Catalog)

Updated with the New Course Numbers

For Undergraduate Mathematics Education Majors

Name:_____ Date: _____

Email:_____ ID: 790- _____

Advisor: _____ Catalog for Graduation: _____

A. General Education Requirements

(i) Competency Requirements

English Writing Skills: (recommended)

WRIT 101 = ENEX 101 (3) (*need C or better*) _____

6 credits in Writing (W) (*need C- or better*)

One of: LIT 110L [=ENLT 120L], LIT 120L [=ENLT 121L], LS 151L, LS 152L (3) _____

Pass Upper Division Writing Proficiency Assessment exam before beginning (>300) M 429W = MATH 406W (3) _____

Mathematical Literacy and Foreign Language/Symbolic Systems:

These requirements are automatically satisfied with a C or better in M 171 = MATH 152.

(ii) Distributional Requirements *(*need C- or better*)*

27 credits; at least 2 credits in each perspective and 6 credits in Perspective #6 with a maximum of 6 credits from any one perspective. One non-western course required among Perspectives #1 – #5. Recommended:

1. Per. 1 (A) COMM 111A (3) _____
2. Per. 2 (L) (one of the writing L-courses listed above) (3) _____
3. Per. 3 (H) NAS 100H (3) _____
4. Per. 4 (S) PSYX 100S = PSYC 100S (4) _____
5. Per. 5 (E) C&I 407E (3) _____
6. Per. 6 (N) (Make sure that these courses count in part D!) Lab: (≥1) _____ Non-lab: _____

Other: (to complete 27 cr.) _____

_____

B. Mathematics Major Requirements (Minor*)

- M 171 = MATH 152 (4)Calculus I _____
- M 172 = MATH 153 (4)Calculus II _____
- M 221 = MATH 221 (4)[1]Linear Algebra _____
- M 301 = MATH 301 (3)Teaching w Tech _____
- M 307 = MATH 305 (3)[1]Intro Abstr Math _____
- M 326 = MATH 326 (3)[2]Number Theory _____
- STAT 341 = MATH 341 (3)Prob & Stat _____

M 429W = MATH 406W (3)History of Math _____

M 431 = MATH 421 (4)[2]Abstract Algebra I _____

- M 439 = MATH 431 (3)Geometry _____
- C&I 430 (4) Teaching Math Methods _____

M/MATH/STAT elective (3-4)[3] _____ _____

***** Courses with an asterisk are required for a mathematics teaching minor.

[1] It is recommended to take M 221 [=MATH 221] before M 307 [=MATH 305].

[2] It is recommended to take M 326 [=MATH 326] before M 431 [=MATH 421].

[3] Must be chosen from M 273, 311, 325, 361, 362, or from MATH 251, 311, 325, 381, 382, or from the 3-4 credit 400-level M/MATH/STAT courses.

C. **Teacher Licensure Requirements**

(a) WRIT 101 = ENEX 101 (3) _____

(b) PSYX 100S = PSYC 100S (4) _____

(c) HHP 233 (3) _____

(d) (Recommended: NAS 100HW) NASL/NAS_____ (3) _____

(e) C&I 200 (1) _____

(f) C&I 303 (3) _____

(g) C&I 407E (3) _____

(h) C&I 410 (3) _____

(i) C&I 427 (3) _____

(j) C&I 430 (4) _____

(k) C&I 301 or 302 (1) _____

(l) HHP 288/289 or current first aid / CPR card (3) _____

(m) C&I 482 (14) _____

(n) C&I 494 (1) _____

C&I 306 waived by M/MATH 301 and C&I 430.

D. Science Requirement and more – SEE NEXT PAGE

D. **Math Major Science Requirement**
Either 12 credits from at most two sciences selected from astronomy, biology, chemistry, computer science, geology, microbiology and physics;
or an additional minor or major;
or an additional teaching minor or major.

_____	_____
_____	_____
_____	_____
_____	_____

Credit Requirement: 128 credits required for graduation.

Grade Requirement: Beginning with the 2005-2006 Catalog, all courses taken to satisfy the requirements of the major must be completed with a grade of C- or better. This applies to all courses listed in **B**, **C**, and **D**!

Transfer Courses: When substituting courses for the 300/400-level M/MATH/STAT courses listed in **B**, please keep the following requirement for all Math B.A. degrees in mind: In addition to M 307 [=MATH 305], six 3- or 4-credit M/MATH/STAT courses numbered 300 or above are required. At least three of the six must be numbered 400 or above. For this requirement, the following courses do not count: STAT 451, 452 [= MATH 444, 445], and M/MATH/STAT courses numbered 390-399 and 490-499.

Advising Guidelines from the 2008-2009 Catalog

References to Sections in the Online Catalog:
APP = "Academic Policies and Procedures",
GUR = "General University Requirements",
RG = "Requirements for Graduation".
These sections are linked from the chapter "Academic Information".

Credit Load: maximum 21 per semester; minimum full-time load 12 per semester (APP; p. 24)

Requirements for a First Bachelor Degree (APP, GUR, RG; pp. 21-33)

- 120 credits total: (RG; p. 26)
  - Minimum of 39 credits in courses numbered 300 or above (RG; p. 26)
  - Maximum of 60 credits in major can be counted toward degree (GUR; p. 32)
- GPA of at least 2.00 in all work attempted in major (GUR; p. 32)
- **Courses taken to satisfy the requirements of the major must be completed with a grade of C- or better.** (GUR; p.32)
- Maximum of 18 "credit/no credit" credits (see APP (or p. 22) for limitations). Note: With the exception of Math 300, all math courses counting towards a math major or minor must be taken for traditional letter grade.
- General education requirements (GUR; pp. 27-31) (transfer students: search for "General Education for Transfer Students" in GUR, or see pp. 31-32)
- Residency requirements (i.e., minimum requirements on the number of credits earned at UM Missoula) (RG; p. 26)
- Students must declare a major before completing 45 credits or after 3 semesters, whichever occurs first. (GUR; p. 32)
- Undergraduates in graduate courses: only post-baccalaureates and seniors having a GPA of 3.0 or greater may, with consent of instructor, enroll in 500-level courses. (APP; p. 24)

Graduation:

- Must apply for degree candidacy nearly 2 semesters before your expected graduation date (RG; p. 25)
- Graduation with Honors or High Honors: See requirements in RG (p. 26) and talk to your advisor.

The University of Montana
Department of Mathematical Sciences
Name _____
Email _____

Date _____
ID 790 - - _____
Catalog for Graduation _____
Math Advisor _____
CS Advisor _____

Advising Worksheet (2008-2009 Catalog)
Updated with the New Course Numbers

B.S. Combined Major in Mathematical Sciences - Computer Science

- **General Education Requirements:**

  Fill out a General Education Worksheet

- **Grade Requirement:** Beginning with the 2005-2006 Catalog, all courses taken to satisfy the requirements of the major must be completed with a grade of C- or better. This applies to all courses listed on this worksheet!

Course no.	*Name*	*Credit*	*Term*	*Grade*
Non-Math/CS Courses				
(1)One of the sequences: BIOL 108N, 109N, 110N **or** CHEM 161N, 162N **or** PHYS 211N & 213N (was 221N) , 212N & 214N (was 222N):				
_____	_____	( )	_____	_____
_____	_____	( )	_____	_____
_____		( )	_____	_____
(2)The course: WRIT 222 = FOR 220	Technical Approach to Writing	(2)	_____	_____
(3)COMM 111A **or** COMM 242 (circle one)		(3)	_____	_____
(4)Upper division writing requirement (in consultation with advisor)				
_____	_____	( )	_____	_____
Core Math Courses				
M 171 = MATH 152	Calculus I	(4)	_____	_____
M 172 = MATH 153	Calculus II	(4)	_____	_____
M 221 = MATH 221	Introduction to Linear Algebra	(4)	_____	_____
M 273 = MATH 251	Multivariable Calculus	(4)	_____	_____
M 307 = MATH 305 (or M 225 = MATH 225	Introduction to Abstract Mathematics Discrete Mathematics)	(3)	_____	_____
Core CS Courses				
CS 121	Careers in Computer Science	(1)	_____	_____
CS 131	Fundamentals of Computer Science I	(3)	_____	_____
CS 132	Fundamentals of Computer Science II	(3)	_____	_____
CS 241	Data Structures	(4)	_____	_____
CS 242	Programming Languages	(4)	_____	_____
CS 281	Computer Architecture & Assembly Language Prog.	(3)	_____	_____
CS 332	Algorithms	(3)	_____	_____

- **Other Math-CS Courses:**

  Each student plans a program in consultation with a mathematical sciences advisor **and** a computer science advisor.

  For your choice of electives, consider the suggested curricula listed below.

Course no.	*Name*	*Credit*	*Term*	*Grade*

Twelve Credits of M/STAT/MATH Electives* selected from 3- or 4-credit courses numbered above 307 (not including courses numbered 390-399 and 490-499).

M/STAT/MATH			( )		
M/STAT/MATH			( )		
M/STAT/MATH			( )		
M/STAT/MATH			( )		

Nine Credits of CS Electives* selected from courses numbered 300 and above. A total of at most three of the nine credits of CS electives may be in CS 398 or 498.

CS			( )		
CS			( )		
CS			( )		

*** Note:** The 12 credits of M/STAT/MATH electives and the 9 credits of CS electives must include at least three 3- or 4- credit courses numbered 400 or above, with at least one chosen from each department (not including M 429 [=MATH 406], nor STAT 451, 452 [=MATH 444, 445].)

M/STAT/MATH/CS	4		( )		
M/STAT/MATH/CS	4		( )		
M/STAT/MATH/CS	4		( )		

- **The Upper-Division Writing Requirement** is one of the following: CS 415E, M 429 [=MATH 406], any other approved General Education upper–division writing course, or a senior thesis (CS 499 or M 499 [=MATH 499]).

- **Suggested Curricula**

Applied Math-Scientific Programming: Three courses chosen from CS 344, 446, 471, 477, 486. In addition:

New Course Numbers:	M	311,	412,	414,	and one of	M	381,	440,	472,	473,	STAT	341.
Old Course Numbers:	MATH	311,	412,	414,	and one of	MATH	351,	471,	452,	451,		341.

Combinatorics and Optimization-Artificial Intelligence: CS 344, 455, and 457. In addition:

New Course Numbers:	M	361,	362,	and two of	M	325,	414,	485,	STAT 341.
Old Course Numbers:	MATH	381,	382,	and two of	MATH	325,	414,	485,	341.

Statistics-Machine Learning: Three courses chosen from CS 365, 455, 457, 458, and 486. In addition:

New Course Numbers:	STAT	341,	421,	and two of	STAT	422,	M	325,	362, 485.
Old Course Numbers:	MATH	341,	441,	and two of	MATH	442,		325,	382, 485.

Algebra-Analysis: CS 344, 441, and one other upper-division CS course. In addition:

New Course Numbers:	M	381,	431,	and two of	M	326,	432,	472,	473.
Old Course Numbers:	MATH	351,	421,	and two of	MATH	326,	422,	452,	451.

The University of Montana – Department of Mathematical Sciences

Advising Worksheet (2008-2009 Catalog)

Updated with the New Course Numbers

For all Undergraduate Math Majors

(Except Math Ed and the Combined Math/CS Major)

(A)General Education Requirements:

☐ Fill out a General Education Worksheet.

(B)Non-Math Courses:

(1) **Either** two courses chosen from CS 101, 131, 132, 201, 207:

Course No.	*Name*	*Credits*	*Term*	*Grade*
		( )		
		( )		

or (equivalent of) second semester of UM Foreign language course:

		( )		

or a second major: _____

(2)Science courses: 18 credits from at most 3 sciences selected from astronomy, biology, chemistry, computer science, economics, forestry, geology, management, microbiology, and physics:

		( )		
		( )		
		( )		
		( )		
		( )		
		( )		

or a minor: _____ **or** a second major: _____

(3)Upper-division writing requirement: **Either** an upper division general education writing course (e.g., M 429 = MATH 406):

		( )		

or a senior thesis (M/MATH 499).

Name: _____ Date: _____

Email: _____ ID: 790- - _____

Advisor: _____ Catalog for Graduation: _____

(C)Core Math Courses:

			Term	*Grade*
M 171 = MATH 152	Calculus I	(4)		
M 172 = MATH 153	Calculus II	(4)		
M 221 = MATH 221	Lin. Alg. (*take before M 307*)	(4)		
M 273 = MATH 251	Multivariable Calculus	(4)		
M 300 = MATH 300	Undergrad. Math Seminar	(1)		
M 307 = MATH 305	Intro. to Abstract Math	(3)		

(D)Option Requirements: If you wish to select an option, check the appropriate box(es) and make sure to choose the courses in **(E)** accordingly. *The option requirements are described on the back.* Note that it is not required to choose an option.

☐ Applied Mathematics ☐ Pure Mathematics

☐ Combinatorics & Optimization ☐ Statistics

(E)At Least 6 Additional 300/400 Level Math Courses: Beyond the core math courses in **(C)**, 6 additional 3- or 4-credit M, MATH, or STAT courses numbered 300 or above are required. At least 3 of the 6 must be numbered 400 or above. The following courses do not count: STAT 451, 452 [=Math 444, 445], and courses numbered 390-399 and 490-499. *If you want to specialize in one of the options, keep the option requirements in mind.*

		( )		
		( )		
		( )		
		( )		
		( )		
		( )		
		( )		
		( )		

With the exception of M/MATH 300, all courses listed on this worksheet, **including the courses under (B)**, must be completed with a grade of C- or better. (This is a new requirement beginning with the 2005-2006 Catalog.)

Option Requirements for the B.A. in Mathematical Sciences:

Applied Mathematics:

New Course Numbers:	M 311, 412, 414,	and one of	M 440, 472.	Recommended:	M 381, 485
Old Course Numbers:	MATH 311, 412, 414,	and one of	MATH 471, 452.	Recommended:	MATH 351, 485

Cominatorics & Optimization:

New Course Numbers:	M 361, 362, 485,	and one of	M 414, 440,	STAT 341, or CS 332.
Old Course Numbers:	MATH 381, 382, 485,	and one of	MATH 414, 471,	MATH 341, or CS 332.

Pure Mathematics:

New Course Numbers:	4 courses chosen from M 381, 431, 432, 472, 473.
Old Course Numbers:	4 courses chosen from MATH 351, 421, 422, 452, 451.

Statistics:

New Course Numbers:	STAT 341, 421, 422.	Additional mathematics and statistics courses chosen with the advisor.
Old Course Numbers:	MATH 341, 441, 442.	

Advising Guidelines from the 2008-2009 UM Catalog

References to Sections in the Online Catalog: APP = "Academic Policies and Procedures", **GUR** = "General University Requirements", **RG** = "Requirements for Graduation". These sections are linked from the chapter "Academic Information".

Credit Load: maximum 21 per semester; minimum full-time load 12 per semester (APP; p. 24)

Requirements for a First Bachelor Degree (APP, GUR, RG; pp. 21-33)

- 120 credits total: (RG; p. 26)
  - Minimum of 39 credits in courses numbered 300 or above (RG; p. 26)
  - Maximum of 60 credits in major can be counted toward degree (GUR; p. 32)
- GPA of at least 2.00 in all work attempted in major (GUR; p. 32)
- **Courses taken to satisfy the requirements of the major must be completed with a grade of C- or better.** (GUR; p.32)
- Maximum of 18 "credit/no credit" credits (see APP (or p. 22) for limitations). Note: With the exception of Math 300, all math courses counting towards a math major or minor must be taken for traditional letter grade.
- General education requirements (GUR; pp. 27-31) (transfer students: search for "General Education for Transfer Students" in GUR, or see pp. 31-32)
- Residency requirements (i.e., minimum requirements on the number of credits earned at UM Missoula) (RG; p. 26)
- Students must declare a major before completing 45 credits or after 3 semesters, whichever occurs first. (GUR; p. 32)
- Undergraduates in graduate courses: only post-baccalaureates and seniors having a GPA of 3.0 or greater may, with consent of instructor, enroll in 500-level courses. (APP; p. 24)

Graduation:

- Must apply for degree candidacy nearly 2 semesters before your expected graduation date (RG; p. 25)
- Graduation with Honors or High Honors: See requirements in RG (p. 26) and talk to your advisor.

Departmental Requirements for Mathematical Sciences B.A. Degree (pp. 128-129)

Math Courses:

- Math 152, 153, 221, 251*, 300*, 305 (* = not required for students in Math Education option)
- Six additional 3- or 4-credit math courses numbered 300 or above, at least three of which are numbered 400 or above. The following courses do not count: 444 or 445, and courses numbered 390-399 and 490-499.
- All mathematics courses counted toward the major must be passed with a grade of C- or better.
- See page 128 for requirements for specific options. (Note: an option is <u>not</u> required.)

Non-Math Courses: (<u>Also these courses must be completed with a grade of C- or better.</u>)

- With exception of students in the math ed option, **<u>either</u>** two computer science courses chosen from CS 101, 131, 132, 201, 207, **<u>or</u>** two semesters of one foreign language, **<u>or</u>** a second major.
- Need to fulfill the science requirement below **<u>or</u>** a minor in any subject **<u>or</u>** a second major.
  Science Requirement: 18 credits in at most 3 sciences selected from astronomy, biology, chemistry, computer science, economics, forestry, geology, management, microbiology, and physics (except for Math Education students who must complete 12 credits in at most 2 sciences selected from astronomy, biology, chemistry, computer science, geology, microbiology and physics).
- Upper division writing requirement: **<u>either</u>** Math 406, **<u>or</u>** any oother approved General Education upper-division writing course, **<u>or</u>** a senior thesis (Math 499).

IV. Operating Policy for the Computer Lab in Math 206

1. Access to the lab during hours of operation: Access to the lab will be as follows: students in certain mathematics classes, math majors, math graduate students, math visiting instructors, and math faculty. ALL lab users will have an **access card** which will be kept in the lab. Upon entering the lab, the user will take her/his card out of the card file, insert it in an empty slot in the card holder on the wall, and complete the sign-in sheet. *You will be asked to show a photo ID until the lab monitor knows you*. Faculty, graduate students, and instructors in the math department will automatically have an access card placed in each lab. All others need to apply for a card.
2. Access to the lab after hours: All mathematics graduate students, instructors, and faculty may use the lab after hours. No one else is allowed in the labs after hours. *After hours, users must sign in and out and are responsible for reporting computer problems and lab violations to Michelle Johnsen as soon as possible*. Anyone allowing in someone who does not have after hours permission will lose their privileges.
3. Lab hours: The hours of operation of the computer labs will be announced each semester and posted in the labs. Occasionally the lab will be reserved for a class and not open for general use. Signs will be posted.
4. Use of the lab: The lab is to be used for doing mathematics, mathematics homework and related work. No games!!! No pornographic pictures!!! etc. Violators will lose their privilege to use the labs.
5. Student Lab Monitors: Whenever the Computer Lab is open, it will have a student monitor in it who will limit access to those students who have been given access to the lab. They will see that the equipment is used appropriately and may be able to answer a few routine questions.
6. Computers: 15 DELL Pentiums II, 1 HP 4050 Post Script Laser Printer are in MA 306 Teaching Lab. The MA 206 Lab has 16 Dell Pentiums, 2 HP 4M Post Script Laser Printers. The computers are on the University's computer network, giving users access to e-mail, internet, etc.
7. Saving things on the lab machines: Students may use the hard drives on lab computers only for temporary storage during a lab session. Students have two alternatives for long-term storage: (1) use diskettes, (2) open an account on Selway and store things there. Hard drives on lab machines will be cleared frequently. Software may only be installed with proper authorization from the computer committee; violators will lose their lab privileges.
8. Printing in the lab: Students may print **single** copies of **mathematical** work that they are doing in the lab - no multiple copies may be printed on these machines and no more than 20 pages. During lab hours of operation, all print jobs can be picked up from a lab monitor. The number of pages printed must be recorded when checking out of the lab. Material printed is limited to that generated as part of the work required for the mathematics course in which the student is enrolled. Use of the color printer is restricted to authorized students only; students wishing to use the color printer may request special permission by filling out a form.
9. Problems in the lab: Any computer errors must be reported on the "computer error log sheet"; more serious problems should be reported to the lab monitor. The Lab is under the supervision of the Computer Committee: Leonid Kalachev, Brian Steele, John Bardsley, and Guy Shepard.

NO FOOD OR BEVERAGES ARE ALLOWED IN THE LAB!!

Software currently on the department's network includes MS WORD, Math Type, MS EXCEL, MS WORKS, Derive, Mathcad, Mathematica, Maple, MATLAB, Data Desk, Stella, S-Plus, Gino, Lindo, Lingo, Aimms, Gino, Gasp, Photoshop, Logo, NETSOLVE, Geometer's Sketchpad, Netscape, Oztex, Excaliber, Alpha, Scientific Workplace, Phase Plane. Software that is available in other labs around campus can be determined from the Computing and Information Services (CIS) information sheet.