

UW-La Crosse Guide for the Math Major



UNIVERSITY *of* WISCONSIN  
LA CROSSE

*Guide  
for the  
Mathematics Major*

**2008-2009**

# UW-La Crosse Guide for the Math Major

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## UW-La Crosse Guide for the Math Major

### I. Introduction

#### WELCOME MATHEMATICS MAJORS!

Whether you are a returning student with a good start on a major, a new freshman committed to mathematics, or just someone considering a major in mathematics at UW-La Crosse, we welcome you.

You will most likely begin your mathematics career at UW-L with either precalculus or calculus. Calculus is one of the greatest achievements of the human intellect, and will serve as the foundation for your further study of mathematics. It is very important that you start your coursework at the level that is appropriate for you. Later in this guide we will discuss placement in mathematics courses and credit by exam. The information on preparation, background and credit by exam in Section III should help you in deciding in which course to start, but we encourage you to talk to an advisor from the Mathematics Department to be sure that you are starting at the right level. You will begin your major with a specific sequence of courses, but after that sequence you will begin to have choices in which upper level mathematics courses you wish to take. In this way, you decide what kind of emphasis you want in your major...whether it be theoretical, applied, education, etc. As a declared math major you will gain access to the Mathematics and Statistics Resource Center. Located in 102 Cowley Hall, the Center provides books, computers, and a location for majors to study, work together on projects, and discuss mathematics and statistics with other students and faculty.

We encourage you to choose a minor (or second major) that complements your mathematics major and gives you a broader range of experience and knowledge. Some minors which are especially good companions to a mathematics major are computer science, computational science or other sciences. As an upper-level student, you may want to consider an off-campus internship. There are also opportunities for you to work one-on-one with a faculty member on a research project. The number and availability of these types of opportunities have been growing rapidly in the past few years. When you graduate, you can look forward to a career in business, industry, governmental agencies or education. Or perhaps graduate school is in your future! Wherever you find yourself after graduation, you can feel confident that your time at UW-L has prepared you well for your future.

With hard work on your part and the assistance of the faculty, we hope that the next few years will be both exciting and rewarding. For more information on UW-L in general, or the Mathematics Department specifically, visit our web pages. The address for the UW-L home page is: [www.uwlax.edu](http://www.uwlax.edu). From there you can follow the links to the home page for the Mathematics Department. The address to get to the department home page directly is: [www.uwlax.edu/mathematics](http://www.uwlax.edu/mathematics). Also, feel free to come and see any of the mathematics faculty with your questions. We are here to help!

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### II. Opportunities After Graduation

#### GENERAL

While your main motivation for choosing mathematics as a major should stem from a combination of a keen interest and high ability in mathematics, you should naturally be interested in the opportunities available after graduation. A mathematics major is in a good position for employment in business, industry, governmental agencies and education. Combining a mathematics major with a second major or minor in a complementary area, such as computer science, increases your opportunities. The prospects are also bright for well-qualified students to obtain support for graduate study in a variety of math related areas.

Many of the national and international mathematics organizations have published information on careers in mathematics and related areas. You can find some of this information on the web pages of the Mathematical Association of American ([www.maa.org](http://www.maa.org)), the American Mathematical Society ([www.ams.org](http://www.ams.org)), and the Society of Industrial and Applied Math ([www.siam.org](http://www.siam.org)). The pamphlets listed below contain useful information about careers for mathematics majors. These are available for you to read in the Math Resource Room (102 Cowley Hall) or online.

- *Careers in Mathematics*
- *101 Careers in Mathematics*, 1996, Mathematical Association of America
- *Professional Opportunities in the Mathematical Sciences*, 1983, Mathematical Association of America
- *Seeking Employment in the Mathematical Sciences*, 1985, American Mathematical Society
- *Careers That Count*, 1991, Association for Women in Mathematics
- *Mathematical Scientists at Work*, 2nd edition, 1991, Mathematical Association of America
- *Math Horizons*, four issues per year, Mathematical Association of America
- *She Does Math! Real -Life Problems from Women on the Job*, 1995, Mathematical Association of America
- *Assistantships and Graduate Fellowships in the Mathematical Sciences*, one issue per year, American Mathematical Society

#### BUSINESS, INDUSTRY, AND GOVERNMENT

Recent employers of our graduates include Blue Cross/Blue Shield, Hewlett Packard, IBM Corporation, M & I Data Systems, Northern Micrographics, State of Iowa Social Work Department, West Publishing, Honeywell Avionics, ITT Hartford Insurance Group, MCI, First Logic, Mayo Clinic and Trane Company. In some cases, employers, having found mathematics majors generally bright and flexible, hire them for positions that may involve considerable training on the job, but not much direct use of their mathematical knowledge. These jobs often make use of the incisive reasoning abilities and broad problem-solving skills that are developed through effective mathematical training. In other positions, mathematics majors may make considerable use of their backgrounds in mathematics, computer science, statistics and science. The possibilities range from positions in management to jobs as programmers, actuaries, or math and computing specialists. To make your college background most valuable, you should take courses in areas in which mathematics is applied: areas such as economics, sociology, psychology, general business, computer science, statistics, and the physical and biological sciences. Every math major at UW-L is

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required to take a two-semester sequence of advanced courses. There are several sequences available depending on the student's interests. Some of the tracks are theoretical in nature for students thinking about graduate school - MTH 411 & 412, MTH 407 & 408, while others are applied tracks -MTH 353 & 480, MTH 353 & 461. There is also a sequence for those interested in Statistics - MTH 441 & 442. If you are interested in a career in industry, you should take the statistics sequence or one of the applied sequences of courses to fulfill this requirement.

Some specific information on job opportunities is displayed on the bulletin board outside of 1011 Cowley Hall. In addition, the Academic Discovery Lab, Room 8, Wilder Hall, is a resource center for gathering information about occupations and educational programs. The Career Services Office, 2nd Floor Wilder Hall, provides students with career and job information, and assists students close to graduation in planning a job search and arranges interviews with visiting employer representatives.

### **EDUCATION**

Teaching mathematics is a challenging and rewarding experience for those who enjoy communicating ideas and working with people. There is currently a serious shortage of qualified mathematics teachers at the middle/secondary level. Because of this, mathematics education majors are currently in high demand in the job market.

Students interested in secondary education complete a math major with course requirements slightly different from their non-teaching counterparts. The requirements are outlined in Section III of this guidebook. You should consult with the School of Education as early as possible so that you can plan your program. There are many requirements that must be met before you can be admitted to the Teacher Education Program, and also to stay in the program. Contact the School of Education in 235 Morris Hall, 785-8122, for more information on specific requirements.

Teaching at the post secondary level usually requires an advanced degree, and students with such interests should plan accordingly. (See GRADUATE STUDIES IN MATHEMATICS this section.)

### **STATISTICS**

A statistician has special training in the collection and analysis of data. Students interested in statistics should plan on taking MTH 441 & 442 as their two-semester sequence of senior level courses. If you are interested in a special applied field of statistics like biometrics, you should also take course work in the appropriate department. Additional information may be obtained from the American Statistical Association, 1429 Duke St., Alexandria, VA 22314-3402 or their web page at [www.amstat.org](http://www.amstat.org).

### **ACTUARIAL**

An actuary deals with problems of insurance, pensions and annuities. Actuaries are employed by insurance companies, governments, labor unions, private industry and actuarial accounting firms. The actuary's basic training is in mathematics, statistics and accounting. Specialized training is usually acquired while the individual is employed as an actuarial trainee.

Qualification for employment consists of passing the basic examinations in undergraduate mathematics and statistics administered by the two actuarial societies: the Society of Actuaries

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([www.soa.org](http://www.soa.org)) focusing on life and health insurance and pensions, and the Casualty Actuarial Society (CSA) - focusing on property and casualty insurance.

For more information on the actuarial field and examinations, contact David Reineke, 1030 Cowley Hall.

### **GRADUATE STUDIES IN OTHER FIELDS**

An undergraduate degree in mathematics is often excellent preparation for graduate work in disciplines where mathematics is used. These areas include computer science, statistics, law, medicine, economics, engineering, operations research, genetics, forestry, physics, meteorology, and various other fields in the social, biological and physical sciences. A student who has taken few courses in his/her area of graduate interest may well be required to take a substantial number of prerequisite courses before beginning the advanced degree program. However, some of these disciplines accept mathematics majors who have had very little background in the area of study.

### **GRADUATE STUDIES IN MATHEMATICS**

There are opportunities for well-qualified students to obtain support for graduate studies in mathematics. Due to the large number of retirements of math faculty at colleges and universities across the country, the market for academic jobs for students with graduate degrees has improved dramatically in the last couple of years. This trend is expected to continue for several years. In addition, some math Ph.D's have obtained non-academic jobs doing consulting or research.

If you are interested in pursuing an advanced degree in mathematics, you should consider taking more than one of the required two semester sequences. The choice of sequences would depend upon your intended area of study (i.e. theoretical or applied mathematics or statistics). Consult with your academic advisor to select the courses that will be important to include in your undergraduate program.

The American Mathematical Society (AMS) and the Society of Industrial and Applied Mathematics (SIAM) have collaborated on a project designed to increase awareness of the employment opportunities outside academia that are available with an advanced degree in mathematics. The centerpiece of the project is the Web site [www.ams.org/careers/](http://www.ams.org/careers/). A new part of this project is an online mentoring program designed to connect students with mathematicians working in industry, government or business. The program is aimed at students who are enrolled in masters or doctoral programs in the mathematical sciences in at U.S. institutions.

Participants are assigned a mentor who will answer general questions about preparation for working in industry and about the work environment in industry, discuss what to expect on an interview, and share their career experiences. In addition, participants can ask mentors to look over the courses already taken and make recommendations about future course work, read over a resume and give feedback from the perspective of someone hiring in industry, and give guidance about putting together a cover letter suitable to industry.

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### APPLYING FOR GRADUATE SCHOOL IN MATHEMATICS

Normally, you should apply in the fall of your senior year for admission the following fall. Most mathematics departments with graduate programs offer, on a competitive basis, financial support for graduate study in the form of teaching assistantships, research assistantships or fellowships. You should apply to departments of varying quality in order to increase chances of admission and/or support.

Usually, letters of recommendation and results of the Graduate Record Examination (GRE) are required with the admissions packet. Some, if not all, of the letters should be from mathematics faculty who know the quality of your work in advanced courses. You should plan to take the GRE General Test and the GRE Mathematics Subject Tests - not all departments require this latter section - in the fall of your senior year. The fall dates are usually in October and December. In some cases it is important to take the October test to be sure the results arrive in time for full consideration for admission and support. (Most departments make final decisions on assistantships in mid-March.)

If you are considering graduate work in mathematics, feel free to ask faculty members about various math departments and graduate programs. Some specific information about graduate programs is available from either Dr. Hulett, 1024 Cowley Hall, or Dr. Reineke for Statistics students, 1030 Cowley Hall. The following should also be useful sources of information about graduate programs.

#### Sources of Information about Graduate Programs in Mathematics

1. *Assistantships and Fellowships in the Mathematical Sciences*. This book is published each fall by the American Mathematical Society, and lists the assistantships and fellowships available for the following academic year. A copy may be purchased from the American Mathematical Society, P.O. Box 6248, Providence, RI 02940.
2. *Peterson's Guides*. Many universities pay to have their programs listed in this publication. Areas described usually include programs of study, research facilities, financial aid, cost of study, cost of living, student group, the community, the university, application procedures, and the faculty.

Some announcements about graduate programs are posted on the bulletin board outside of 1011 Cowley Hall, and in the Math Resource Room 102 Cowley.

### III. Mathematics Major/Minor Requirements

#### PREPARATION AND BACKGROUND

The usual high school background possessed by our students includes four years of mathematics: normally two years of algebra, a year of geometry, and a year of precalculus with trigonometry/calculus. Of course, not all students who come to UW-L and plan to major in mathematics have this background, and we offer Precalculus (MTH 151) for these students.

Math placement tests are given to high school students in the spring of their senior year. (See Counseling and Testing web site, [www.uwlax.edu/Counseling/](http://www.uwlax.edu/Counseling/)). These tests are given at local college campuses, and are used to help incoming freshmen choose in which mathematics course to initially enroll. The placement test scores are available to freshmen during their initial registration. Students with questions about their placement are encouraged to talk with a member of the Mathematics Department.

#### CREDIT BY EXAM/RETROACTIVE CREDITS

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The Mathematics Department offers credit by examination in MTH 150 - College Algebra, MTH 151 - Precalculus, MTH 207 - Calculus I and MTH 208 - Calculus II. The exams are *only* available for incoming freshmen. The credit by exam for MTH 150 is usually given in the second week of class in the Fall semester. The other exams (MTH 151, MTH 207 or MTH 208), are given on an individual basis. See the Department chair, Dr. Riley (1021 Cowley) to make arrangements for these exams. *Students may only receive credit for one of MTH 150 or MTH 151.* You will also be given credit for MTH 207 if you are an entering freshman with a College Board Advanced Placement AB exam score of 3 or above. If you received a score of 3 or above on the BC form of this exam, you should consult with the Mathematics Department chair about additional credit besides MTH 207, and about placement in mathematics courses.

In addition, students earning a grade of "B" or better in their first attempt at MTH 207, MTH 208, MTH 309, or MTH 310 will be given retroactive credit for MTH 151 provided that the student's transcript shows no prior or concurrent enrollment in MTH 151, MTH 207, MTH 208, MTH 309, or MTH 310.

All of these opportunities can help to increase your number of credits earned, which in turn may allow you to register earlier. With the number of classes filling up early during registration, this can be a real advantage.

### GENERAL DEGREE REQUIREMENTS

At present students are required to earn a minimum of 120 semester credits, at least 40 of which must be in courses numbered 300 or above. They must maintain at least a 2.00 grade point average overall, as well as in each major and minor. They must also fulfill General Education requirements and the Core requirements of their college.

General Education requires a minimum of 48 credits to be earned among a variety of offerings according to certain distribution requirements. Two courses that emphasize writing must be taken, at least one of which is in the major. *The Mathematics Department has a writing-across-the-major program that incorporates writing throughout the major. In particular, specific types of writing are included in the calculus sequence (MTH 207, 208, 309, 310). Any student completing a Mathematics major will automatically have completed the writing emphasis requirement in general education.* All students have some choice in fulfilling the requirements for General Education, but students from the School of Education will find less flexibility due to state standards (General Education Check Sheet for education majors are available in Morris Hall).

Core requirements for a Bachelor of Science degree in the College of Science and Allied Health involve, in addition to earning your mathematics major, completion of two lab science courses and completion of a minor or a second major or 18 credits at the 300 or 400 level in courses outside the mathematics department. This degree earned in the School of Education involves different core requirements, and requires a number of courses in Professional Education and Psychology culminating in a 15-credit student teaching or teaching internship experience. Bachelor of Arts degree requirements are also slightly different.

University and College requirements force breadth of studies, and provide students the chance to complement their mathematics studies with beneficial coursework from a number of disciplines.

Students are reminded of their progress through these requirements each semester. A report commonly known as a SNAP report is issued to the student's faculty advisor, and claimed by the student. SNAP reports also contain good advice, including directions on where to go to obtain answers to questions concerning requirements. SNAP reports provide an opportunity for a get-together between students and their faculty advisors. A sample SNAP report for a mathematics major is included in the appendices. This SNAP report would be for an incoming freshman Mathematics major with no credits yet taken at UW-L.

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The requirements for graduation do change from time to time. Check the Undergraduate Catalog for more information. Students accept the graduation requirements in force at the time of enrollment, while having the right to switch to the requirements of a subsequent catalog.

The current catalog is a part of the University's home page ([www.uwlax.edu](http://www.uwlax.edu)). Catalogs can be purchased from the Bookstore. The catalog initially governing a student's graduation requirements will be given to the student at the time textbooks are picked up in the first semester of residence.

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### Mathematics Major Requirements

#### Mathematics Major

(All Colleges)

38 credits

The following 7 courses are required:

- 207 Calculus a I (5)
- 208 Calculus II (4)
- 225 Logic and Discrete Mathematics (4)
- 309 Linear Algebra with Differential Equations (4)
- 310 Calculus III: Multivariate Calculus (4)
- 407 Real Analysis I (4)
- 411 Abstract Algebra I (4)

Also 9 additional credits chosen from:

- 311 Number Theory (3)
- 317 Graph Theory (3)+
- 320 History of Mathematics (3)
- 331 Intro. to Modern Geometry (3)
- 341 Probability and Statistics (4)
- 353 Differential Equations (3)
- 371 Intro. to Numerical Methods (3)+
- 408 Real Analysis II (3)
- 410 Complex Analysis (3)
- 412 Abstract Algebra II (3)
- 413 Topics in Linear Algebra (3)
- 441 Mathematical Statistics I (3)
- 442 Mathematical Statistics II (3)
- 461 Mathematical Physics (3)^
- 480 Studies in Applied Mathematics (3)
- C-S 453 Intro to Theory of Computation(3)+
- PHY 470 Adv. Quantum Mechanics(4)^

In addition C-S 120 Software Design I (4) must be taken

+ Math/Computer Science double majors may count MTH 317, 371 and C-S 453 for credit in both majors

^ Math/Physics double majors may count MTH 461 and PHY 470 for credit in both majors.

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### **Mathematics Major with Applied Emphasis** **(All Colleges, excluding Teacher Certification Programs)** **39 credits**

The following 7 courses are required:

- 207 Calculus I (5)
- 208 Calculus II (4)
- 225 Logic and Discrete Mathematics (4)
- 309 Linear Algebra with Differential Equations (4)
- 310 Calculus III: Multivariate Calculus (4)
- 353 Differential Equations (3)
- 371 Intro. To Numerical Methods (3)

One of the following courses must be taken:

- 461 Mathematical Physics (3)
- 480 Studies in Applied Mathematics (3)

Also 9 additional credits chosen from:

- 341 Probability and Statistics (4)
- 407 Real Analysis I (4)
- 408 Real Analysis II (3)
- 410 Complex Analysis (3)
- 413 Topics in Linear Algebra (3)
- 441 Mathematical Statistics I (3)
- 442 Mathematical Statistics II (3)
- 448 Operations Research (3)
- 461 Mathematical Physics (3)
- 480 Studies in Applied Mathematics (3)

Three of the 9 additional credits may be met by completing one of the following courses:

- CHM 310 Physical Chemistry Theory II (3)
- C-S 453 Intro. To Theory of Computation (3)
- PHY 470 Adv. Quantum Mechanics (4)
- PHY 474 Adv. Computational Physics (4)

In addition, C-S 120 must be taken.

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### Mathematics Major with Education Emphasis

(All Colleges, students seeking teaching certification should complete the major through the School of Education).

**38 credits**

The following 8 courses are required:

- 207 Calculus I (5)
- 208 Calculus II (4)
- 225 Logic and Discrete Mathematics (4)
- 309 Linear Algebra with Differential Equations (4)
- 310 Calculus III: Multivariate Calculus (4)
- 331 Intro. to Modern Geometry (3)
- 341 Probability and Statistics (4)
- 411 Abstract Algebra I (4)

Also 6 additional credits chosen from:

- 151 (If taken for grade rather than retro-credit)
- 311 Number Theory (3)
- 317 Graph Theory (3)
- 320 History of Mathematics (3)
- 353 Differential Equations (3)
- 371 Intro. to Numerical Methods (3)
- 407 Real Analysis I (4)
- 410 Complex Analysis (3)
- 413 Topics in Linear Algebra (3)
- 441 Mathematical Statistics I (3)
- 442 Mathematical Statistics II (3)
- 461 Mathematical Physics (3)^
- 480 Studies in Applied Mathematics (3)

In addition C-S 120 Software Design I (4) must be taken

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### **Mathematics Major with Emphasis in Statistics** **(All colleges, excluding Teacher Certification programs)** **40 credits**

The following 11 courses are required:

- 207 Calculus I (5)\*
- 208 Calculus II (4)
- 305 Statistical Methods (3)
- 309 Linear Algebra with Differential Equations (4)
- 310 Calculus III: Multivariate Calculus (4)
- 341 Probability and Statistics (4)
- 440 Statistical Consulting (1)
- 441 Mathematical Statistics I (3)
- 442 Mathematical Statistics II (3)
- 445 General Linear Models (3)
- 446 Analysis of Variance and Design of Experiments

Also 3 additional credits chosen from:

- 371 Intro. to Numerical Methods (3)
- 407 Real Analysis I (4)
- 447 Nonparametric Statistics (3)
- 449 Applied Multivariate Statistics (3)

In addition C-S 120 Software Design I (3) must be taken

+ Math/Computer Science double majors may count MTH 317, 371 and C-S 453 for credit in both majors

^ Math/Physics double majors may count MTH 461 and PHY 470 for credit in both majors

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### **Mathematics Major with Concentration in Actuarial Science** **(All colleges, excluding Teacher Certification programs)** **55 credits**

The following 16 courses are required:

- MTH 207 Calculus I (5)\*
- MTH 208 Calculus II (4)
- MTH 305 Statistical Methods (3)
- MTH 309 Linear Algebra with Differential Equations (4)
- MTH 310 Calculus III Multivariate Calculus (4)
- MTH 341 Probability and Statistics (4)
- MTH 440 Statistical Consulting (1)
- MTH 441 Mathematical Statistics I (3)
- MTH 442 Mathematical Statistics II (3)
- MTH 445 Correlation and Regression Analysis (3)
- MTH 446 Analysis of Variance and Design of Experiments (3)
- ECO 110 Microeconomics and Public Policy (3)
- ECO 120 Global Macroeconomics (3)
- ACC 221 Accounting Principles I (3)
- ACC 222 Accounting Principles II (3)
- FIN 355 Principles of Financial Management (3)

Also 3 additional credits selected from:

- MTH 371 Introduction to Numerical Methods (3)
- MTH 407 Real Analysis I (4)
- MTH 447 Nonparametric Statistics (3)
- MTH 448 Operations Research (3)
- MTH 449 Applied Multivariate Statistics (3)

In addition, C-S 120 Software Design I (3) must be taken

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### **Mathematics/Engineering Dual Degree Program**

#### **Required Mathematics Courses:**

- MTH 207 Calculus I (5 credits)
- MTH 208 Calculus II (4 credits)
- MTH 225 Mathematical Logic (3 credits)
- MTH 309 Linear Algebra and Differential Equations (4 credits)
- MTH 310 Calculus III: Multivariate Calculus (4 credits)
- MTH 341 Probability and Statistics (4 credits)
- MTH 353 Differential Equations (3 credits)
- MTH 371 Introduction to Numerical Methods (3 credits)
- MTH 461 Mathematical Physics or MTH 480 Studies in Applied Mathematics (3 credits)

#### **Required Non-Mathematics Courses:**

- CHM 103 General Chemistry I (5 credits)
- CHM 104 General Chemistry II (5 credits)
- C-S 120 Software Design I (4 credits)
- ECO 110 Microeconomics and Public Policy (3 credits)
- ECO 120 Global Macroeconomics (3 credits)
- ECO 336 Women in the U.S. Economy (3 credits)
- PHY 203 General Physics I (4 credits)
- PHY 204 General Physics II (4 credits)
- PHY 321 Classical Mechanics (3 credits)

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### Mathematics Minor Requirements

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#### **Mathematics Minor with Education Emphasis** (All Colleges)     24 credits

The following 6 courses must be taken:

- 207 Calculus and Analytic Geometry I (5)
- 208 Calculus II (4)
- 225 Logic and Discrete Mathematics (4)
- 309 Linear Algebra with Differential Equations (4)
- 331 Intro. To Modern Geometry (3)
- 341 Probability and Statistics (4)

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#### **Mathematics Minor** (College of Business, College of Liberal Studies, and College of Science and Allied Health ) 22 credits

The following 3 courses must be taken:

- 207 Calculus/Analytic Geometry I (5)
- 208 Calculus II (4)
- 309 Linear Algebra with Differential Equations (4)

Also, 9 additional credits chosen from: (MTH 151 Precalculus may be used to fulfill 3 of the 9 additional credits.\*\*)

- 225 Logic and Discrete Mathematics (4)
- MTH course numbered 310 and above

\*\*Students earning a grade of “B” or better in their first attempt at MTH 207, MTH 208 or MTH 309 will be given retroactive credit for MTH 151 provided that the student’s transcript shows no prior or concurrent enrollment in MTH 151, MTH 207, MTH 208, MTH 309.

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### **Mathematics Minor** **(Elementary/Middle Level Education Program) 22 credits**

The following 5 courses must be taken:

- 125 Mathematics for Elementary Teachers (4)
- 126 Mathematics for Elementary Teachers II (4)
- 171 Geometry for Elementary Teachers (3)
- 280 Problem Solving for Elementary Teachers (3)
- 175 Applied Calculus (4) OR 207 Calculus/Analytic Geometry (5)

Also, 4 additional credits chosen from:

- 145 Elementary Statistics (4)
- 151 Precalculus (4)
- 208 Calculus II (4)

MTH courses numbered 300 and above

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### **Statistics Minor (All Colleges) 20 credits**

The following 3 courses must be taken:

- 145 Elementary Statistics (4)
- 175 Applied Calculus (4) or 207 Calculus I (5)
- 305 Statistical Methods (3)

Also, 9 additional credits chosen from:

- 445 General Linear Models (3)
- 446 Analysis of Variance (3)
- 447 Nonparametric Statistics (3)
- 448 Operations Research (3)
- 449 Applied Multivariate Statistics (3)

With the approval of the mathematics department chair, a research methods course from another department may be substituted for three of the nine additional credits. MTH 341 may be substituted for MTH 145. This minor is not available to mathematics majors.

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### Mathematics Major/Minor Requirements

#### COURSE OFFERING PATTERN

In order for you to be able to carefully plan your program, you will need to keep in mind the offering pattern for courses, particularly the upper level mathematics courses.

The following courses are offered every semester:

050, 051, 125, 126, 145, 150, 151, 175, 207, 208, 225, 309, 310, 341, 440

The remaining courses are offered according to the following pattern:

Fall, Odd	Spring, Even	Fall, Even	Spring, Odd
171	280	171	280
305	331	305	320
317	371	311	331
353	410	317	371
407	412	353	408
411	442	407	413
441	447	411	446
449	480	445	448
			461

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### IV. Activities, Honors and Facilities

#### **MATH CLUB**

The math club is a recognized student academic club with many social and educational activities of interest to anyone interested in mathematics or statistics. This includes, but is not limited to, things like fun mathematical talks by invited speakers, math trivia contests, picnics, potluck dinners and parties, trips to student math conferences, and friendly sporting contests with other academic clubs. The invited talks are at a level appropriate for undergraduate math majors. These talks cover topics in mathematics not ordinarily covered in regular courses, from pure mathematics to the best way to get a job after graduating. In recent years we have had talks on the mathematics of rainbows, the irrationality of  $e$ , the mathematics of music and the mathematics behind compact discs, just to name a few. Some presentations are to help students make better decisions about their career options. We had a professional engineer talk about the mathematics used in the engineering work place, an Actuarial Fellow talked about the actuary field and a staff member from the campus career services office talked about the many different types of companies that typically hire math majors.

The club is run almost entirely by students on a volunteer basis with elected student officers; membership and participation are very casual. A typical get-together is attended by members, their friends, and some math faculty. The primary goal of the club is to have fun with education running a close second. We meet 10 to 12 times a year, usually in the late afternoon or early evening. Meetings include such goodies as free cookies, donuts, soda, etc. A popular activity is the creation each year of an official math club tee shirt designed by club members. The design is usually of a humorous nature and is popular with club members.

#### **MAA STUDENT CHAPTER**

In conjunction with the UW-L Math Club we have formed a Student Chapter of the Mathematical Association of America (MAA). The MAA is one of the major organizations of the American mathematical community. Our Student Chapter members join a network of over 400 Chapters that provide students an opportunity to participate in the professional mathematical community through membership in the MAA. The benefits of Student Chapter membership include membership in the MAA, subscription to FOCUS - which helps keep them up-to-date with what is going on in the mathematical community - and to one or more of the MAA journals - all at a very low cost.

#### **PUTNAM EXAM**

The William Lowell Putnam Mathematical Competition is an annual exam given nationally to any interested undergraduate. The exam emphasizes cleverness rather than detailed knowledge of sophisticated mathematics. Each year, several thousand of the nation's best mathematical students take the exam with top performers winning cash and scholarships. The exam is free and strictly voluntary, with no adverse consequences for poor performance. The national exam day is the first Saturday in December each year. The UW-L Math Department administers the test on campus when there is enough student interest. Usually several students rise to the challenge. In some years, when interest has been sufficiently great, we have even had practice sessions with the help of the faculty to prepare for the exam.

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### HONORS AND AWARDS

Each spring the Mathematics Department gives out an Outstanding Senior Math Student award. The senior receives a certificate, and his/her name is engraved on a plaque, which is displayed in the display case across from the tutor room, 102 Cowley Hall. The plaque was paid for by donations from the Mathematics faculty. The faculty also make the nominations and choose the winners. Previous winners are: 1995 - Michael Axtell, 1996- Christopher Milne, 1997- Sara Schuh, 1998 - Christine Cumming, 1999 - Tim Urness, 2000 –Nick Roland, 2001 – Clifton Youngbauer, 2002 – Kevin Hufnagl, 2003 - Eric Lunde, 2004 – Heidi Heiden, 2005 – Mike Dodge, 2006 – Lena Spargo, 2007 – Craig Tainter; 2008 – Jarod Hart. At the same time, the faculty also gives the Outstanding Junior Mathematics Student Award. The junior receives a certificate and a scholarship.

In addition, each year, the Murphy Awards for Academic Excellence are given to the top two graduating scholars (from any field of study) from the entire university. Since its inception in 1982, several of the winners have been mathematics majors.

### V. Scholarships and Departmental Tutoring Opportunities

#### SCHOLARSHIPS

A number of endowment funds have been established by alumni, faculty, parents, students, business and other organizations. Annual earnings from the investment of these permanent funds provide scholarships, awards and grants to students. These programs are administered by the University of Wisconsin - La Crosse Foundation, Inc. Further information is available from the Advancement Office located in the Cleary Center. Deadline for application is March 1 for the following fall term. Many of these scholarships are open to all students and based on academic achievement. Some scholarships are awarded on a financial need basis.

Some scholarships are reserved for students in particular areas of study. The following scholarships should be of particular interest to mathematics students:

- AAUW Scholarship in Math and Science (junior or senior math or science majors)
- John Gruden Memorial (junior who is a La Crescent, Minn. High School graduate majoring in math or computer science)
- Eric McIlraith Scholarship in Mathematics (math majors)
- Leo and Gertrude Schnur Scholarship in Mathematics (senior math majors)
- Oliver A. Stoffer (junior or senior math, biology, chemistry, geography, or physics majors)
- Robert and Judy Strzelczyk Scholarship (seniors in college of science & allied health)
- Arnold Temte Mathematics Honors Scholarship (junior or senior math majors)
- Mathematics Faculty Freshman Scholarship (incoming freshmen math majors)
- Theodore W. and Alice O. Rozelle Scholarship in Mathematics (incoming freshmen math majors).

For more information on applying for these and other scholarships, please go to the UW-L Foundation website for information and application forms. ([www.foundation.uwlax.edu/sch.html](http://www.foundation.uwlax.edu/sch.html))

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In addition to the endowed scholarships is the **Outstanding Junior Mathematics Student Scholarship and Award** (Junior Math Majors). The Mathematics faculty nominate students for this scholarship. (Students do not apply.) This scholarship is funded by the Mathematics faculty.

### DEPARTMENTAL TUTORING

The UW-L Math Department host a tutoring center in Whitney Center in mathematics and statistics. The tutoring is free and generally available from 8 a.m. to 8 p.m., Monday through Thursday until noon on Fridays, and noon until 9:00 p.m. Sundays. Please check the Math Department website for locations and times each Semester. The tutors are qualified students, usually upper class math majors. Generally, tutors are able to help students in all math classes up through the 200 level. This includes basic general education courses as well as Calculus I & II, and Logic. There are also help sessions offered each week for some courses.

Check the website at [www.uwlax.edu/mathematics/dept/LearningResources/Help%20Sessions.htm](http://www.uwlax.edu/mathematics/dept/LearningResources/Help%20Sessions.htm)

For mathematics majors, the primary benefit of the tutor room is the opportunity for convenient on campus part-time employment. Tutors can work from 5 to 15 hours a week with a schedule compatible with their own class schedule. Furthermore, the tutors acquire valuable experience that will surely impress prospective employers after graduation.

### VI. Internships and Undergraduate Research Opportunities

The number of opportunities for undergraduate research in the mathematics department has dramatically increased recently. More and more faculty are hiring students as research assistants on research projects. In addition, since the 1996-97 academic year, money has been set aside annually for an Undergraduate Research Grant Competition. Students can write up a proposal, with a faculty member for guidance, to compete for a portion of the \$20,000 available in this fund. In addition, a new college level undergraduate research grant began during the 1998-1999 academic year. The number of opportunities for students interested in undergraduate research continues to grow.

Opportunities for internships have also exploded in the recent past. Places where our students are interning include Argonne National Lab, Motorola, Postalsoft, the National Science Foundation, NASA and others. For both the research and internship opportunities, a mathematics/computer science double major or major/minor combination has been an especially good combination. If you would like to get involved in a research project or internship in the future, don't put off taking your upper level mathematics courses. The most common time for either a research project or an internship is the summer following your third year. In order to be competitive, you will want to have a wide variety of mathematics courses and probably some computer science courses completed by that time.

### VII. Contact After Graduation

We hope that you will continue to feel a part of this department after you have obtained your degree. Once a year the department sends out an Alumni Newsletter. Through it, you will be able to keep abreast of changes in your department. Each issue contains summaries of what is happening within the department, information on new faculty, the names of the Outstanding Senior and Junior Mathematics

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Students for that year as well as other honors and awards received by students and faculty. In addition, the newsletter includes a section on alumni news. This is your way to keep us (and your fellow alumni) informed on what you are doing. After you have graduated, we hope that you will keep us informed on what you are up too, so we can include the information in future newsletters.

We encourage you to join the UW-L Alumni Association, to contribute to the Mathematics Department Fund to help current and future mathematics students, and to return to campus to visit your department whenever possible.

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### COURSE DESCRIPTIONS:

#### **MTH 050 Basic Algebra Cr. 3 transcript\***

A review of beginning algebra. Topics include an elementary treatment of real numbers, polynomials, linear equations, inequalities, rational expressions, systems of linear equations, radicals, and quadratic equations. Letter grade, but only F calculated in GPA.

#### **MTH 051 Topics in Intermediate Algebra Cr. 2 transcript\***

A course to enhance the student's skills in selected areas of intermediate algebra; areas covered include polynomials, rational expressions, exponents, equations, and inequalities. Prerequisite: MTH 050 or an appropriate placement test score. Letter grade, but only F calculated in GPA.

\* Transcript credit does not count toward graduation.

#### **MTH 125 Mathematics for Elementary Teachers I Cr. 4**

A study of the mathematical concepts and techniques that are fundamental to, and form the basis for, elementary school mathematics. Topics include: problem solving, inductive and deductive reasoning, sets, number systems through the real numbers, number theory, measurement, and 2- and 3-dimensional geometry. Prerequisite: MTH 051 or satisfactory placement test score.

#### **MTH 126 Mathematics for Elementary Teachers II Cr. 4**

Continued Study of the mathematical concepts and techniques that are fundamental to, and form the basis for, elementary school mathematics. Topics include: use of probability and statistics to explore real-world problems; representation and analysis of discrete mathematical problems using counting techniques, sequences, graph theory, arrays and networks; use of functions, algebra and the basic concepts underlying the calculus in real-world applications.

#### **MTH 145 Elementary Statistics Cr. 4**

An introductory course covering fundamentals of modern statistical methods. Topics include descriptive statistics, the binomial and normal distributions, estimation, and hypothesis testing. The z, t, F and chi-square test statistics are introduced. Instruction in computer use is included, and statistics software is used throughout the course for analyzing data files and carrying out statistical procedures. Prerequisite: MTH 050 or an appropriate placement test score.

#### **MTH 150 College Algebra Cr. 4**

A college algebra course on the properties, graphs, and applications of elementary functions. Topics include the real and complex numbers, concepts from analytic geometry, solutions to equations and inequalities, the elementary algebraic functions, and the logarithmic and exponential functions. Prerequisite: MTH 051 or two years of high school algebra and an appropriate placement test score. (Successful completion of MTH 151, 175 or 207 precludes taking MTH 150 for credit.)

#### **MTH 151 Precalculus Cr. 4**

A precalculus course on properties, graphs, and applications of elementary transcendental functions. Topics include concepts from analytic geometry; theory of equations; the logarithmic, exponential, trigonometric, and inverse trigonometric functions; and analytic trigonometry. Prerequisite: MTH 150 or two years of high school algebra and an appropriate placement test score. (Successful completion of MTH 151 precludes taking MTH 150 for credit. Successful completion of MTH 207 precludes taking MTH 151 for credit.)

#### **MTH 171 Geometry for Elementary Teachers Cr. 3**

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Analysis and description of 2- and 3-dimension geometric concepts. Intuitive, direct, and indirect proofs and applications of geometric principles. Transformations, similarities and symmetry. Some topics from measurement. Prerequisite: MTH 125 and either MTH 150 or math placement above MTH 150. Offered Sem. I.

### **MTH 175 Applied Calculus Cr. 4**

Basic concepts and methods from differential, integral, and multivariate calculus. Logarithmic and exponential functions are included, but not trigonometric functions. Emphasis of the course is on models and applications in business and the social, life, and physical sciences. Prerequisite: MTH 150 or two years of high school algebra and an appropriate placement test score. (Successful completion of MTH 175 precludes taking MTH 150 for credit. Successful completion of MTH 207 precludes taking MTH 175 for credit.)

### **MTH 207 Calculus and Analytic Geometry I Cr. 5**

A rigorous introduction to calculus. Topics include limits, rules for differentiation, derivatives of trigonometric, logarithmic, and exponential functions, the Mean Value Theorem, integration, and the Fundamental Theorem of Calculus. In the area of applications, the course covers problems on related rates, extrema, areas, volumes, and Newton's Second Law. Prerequisite: MTH 151 or four years of high school mathematics, including trigonometry and appropriate math placement score. (Successful completion of MTH 207 precludes taking MTH 151 or 175 for credit.)

### **MTH 208 Calculus II Cr. 4**

A continuation of Calculus I, with an introduction to sequences and series. Topics include techniques of integration and indeterminate forms, improper integrals, applications of integrals to the physical sciences, tests for the convergence of series, absolute convergence, power series, and Taylor's Theorem with Remainder. First order linear differential equations are explored, as well as the geometry of space. Prerequisite: MTH 207.

### **MTH 225 Logic and Discrete Math Cr. 4**

An introduction to mathematical reasoning. Mathematical logic, including quantification and the predicate calculus is introduced and used to discuss set theory, relations, functions, counting, graphs, and algorithms. Elementary proofs, including proofs by induction are stressed. Prerequisite: MTH 175 or MTH 207.

### **MTH 280 Problem Solving for Elementary Teachers Cr. 3**

A high activity course designed to enhance skills in problem solving. Includes methods of representing problems, general strategies for solving problems, creative problem posing and ways to evaluate progress in problem solving skills. Examples taken from the elementary school curriculum. Prerequisite: MTH 125 and either MTH 150 or math placement above MTH 150. Offered Sem. II.

### **MTH 305/505 Statistical Methods Cr. 3**

A survey of statistical methods from the point of view of how these methods are implemented with a standard statistics software package. Topics include descriptive statistics, graphical methods, tests of location, goodness of fit, simple and multiple regression, design of experiments, ANOVA, multiple comparisons, chi-square tests. Both parametric and nonparametric methods are treated. Computer use is an integral part of the course. Prerequisite: MTH 145 or 341. Usually offered Semester I.

### **MTH 309 Linear Algebra with Differential Equations Cr. 4**

A systematic study of linear algebra with differential equations. Topics include: vectors, matrices, systems of linear equations, determinants, vector spaces, subspaces, basis and dimension, linear transformations and their matrix representations, similar matrices and diagonalization, systems of first order linear differential equations, and higher order linear differential equations. Prerequisite: MTH 208

### **MTH 310 Calculus III Multivariate Calculus Cr. 4**

A course in higher dimensional calculus, partial derivatives, and multiple integrals. Topics include parametric curves, polar (and other) coordinate systems, vector fields, scalar fields, the gradient vector, chain rule, Jacobian,

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Green's Theorem, Stokes' Theorem, and the Divergence Theorem.. Prerequisite: MTH 208.

### **MTH 311** Number Theory **Cr. 3**

Topics are selected from such areas as: divisibility and factorization, congruence, distribution of prime numbers, Diophantine equations. Problem-solving strategies and unsolved problems are stressed. Applications to areas such as coding theory. Prerequisite: MTH 225 and 309 or concurrent enrollment. Usually offered Semester I, even numbered years.

### **MTH 317** Graph Theory **Cr. 3**

An introduction to graph theory emphasizing algorithms. Topics include: graphs and subgraphs, isomorphism, degree sequences, digraphs, networks, algorithmic complexity and NP-completeness, trees, Euler circuits and Hamilton cycles, planarity, and graph coloring. Prerequisites: MTH 225, MTH 309, C-S 120. Usually offered Semester I, odd numbered years.

### **MTH 320** History of Mathematics **Cr. 3**

A study of the evolution of mathematics. Discussion and evaluation of major periods of development including the lives and works of preeminent mathematicians. A sampling of problem solving methods from various historical periods. Emphasis is on Western mathematics from earliest recorded history through the initial developments of calculus and modern mathematics. Prerequisite: MTH 309 or concurrent enrollment. Usually offered Semester II, odd numbered years.

### **MTH 331** Introduction to Modern Geometry **Cr.3**

A thorough discussion of transformations and their use in proving congruence of geometric figures; selected theorems concerning the triangle and circle, and constructions possible given different parts of a triangle. Prerequisite: MTH 225 and 309 or concurrent enrollment. Usually offered Semester II.

### **MTH 341** Probability and Statistics **Cr. 4**

An initial course in probability and statistics for students strong in mathematics. Probability topics include samples spaces, random variables, independence, and the binomial, Poisson, normal, and exponential distributions and their applications. Calculus-based methods will be used for analyzing continuous distributions. Statistics topics include descriptive statistics, sampling distributions, confidence intervals, hypothesis testing, regression, and ANOVA.

### **MTH 353** Differential Equations **Cr. 3**

Fundamental existence and uniqueness theory, linear independence and the Wronskian, series solutions near regular singular points, Laplace transforms and systems of first order linear equations. Fourier series and the method of separation of variables will be applied to the heat equation, wave equation, and Laplace's equation. Prerequisite: MTH 309 and MTH 310. Usually offered Semester I.

### **MTH 371** Introduction to Numerical Methods **Cr. 3**

Techniques devised for use with computing machinery are applied to problems such as: solving non-linear equations and linear systems, curve-fitting and function approximation, numerical integration. Prerequisites: MTH 309 and C-S 120. Usually offered Semester II.

### **MTH 395** Special Topics in Mathematics **Cr. 1-3**

Special topics in mathematics not covered by regular courses taught in this department. The particular topic is decided mutually by the student and instructor. Prerequisite: written consent of department chair. Repeatable for credit -- maximum 6.

### **MTH 407** Real Analysis I **Cr. 4**

This course covers the basic theory underlying the differential and integral calculus. Convergence of sequences and series is examined. Theoretical concepts of calculus are examined and particular attention is given to writing proofs.

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Prerequisite: MTH 225, MTH 309, and MTH 310. Offered Fall Semesters only.

### **MTH 408** Real Analysis II **Cr. 3**

Further study of real analysis via selected topics such as the theory of convergence, Lebesgue-Stieltjes integration, Fourier Analysis, probability theory, approximation theory and metric-spaces. Prerequisite: MTH 407. Offered Spring semester, odd years only.

### **MTH 410** Complex Analysis **Cr. 3**

Introduction to complex numbers and complex functions. Analytical functions are developed via power series and Cauchy's Theorem. Topics include: Cauchy-Riemann conditions, integration theorems, residues, conformal mapping and applications. Prerequisite: MTH 309 and MTH 310. Usually offered Semester II, even numbered years.

### **MTH 411** Abstract Algebra I **Cr. 4**

A rigorous approach to algebraic systems including the study of groups, rings, integral domains and fields with application to polynomials. Prerequisite: MTH 225 and 309.

### **MTH 412** Abstract Algebra II **Cr. 3**

Continuation of MTH 411. Further study of rings, integral domains and fields. Prerequisite: MTH 411. Offered Sem. II, even-numbered years.

### **MTH 413** Topics in Linear Algebra **Cr. 3**

A thorough study of selected topics such as abstract vector spaces, linear transformations and their matrix representations, inner product spaces, canonical forms and selected applications. Prerequisites: MTH 225 and MTH 309. Usually offered Semester II, odd numbered years.

### **MTH 440** Statistical Consulting **Cr. 1**

Experiences will include interpersonal written and oral communication and interdisciplinary exposure as well as opportunities to apply statistical knowledge in a broad variety of situations. Students will take part in consultations (i.e. extracting information, listening, asking appropriate questions), apply knowledge in experimental design, data modeling, use of statistical software, and/or sampling; diagnose and conduct appropriate statistical procedures and interpret and communicate results. Reading past and present literature on statistical consulting also will be required. Prerequisite: MTH 305 or MTH 341 and written consent of the Statistical Consulting Center director.

### **MTH 441** Mathematical Statistics I **Cr. 3**

Review of discrete and continuous random variables. Moment generating functions, multivariate probability distributions, marginal and conditional probability distributions, functions of random variables, order statistics, Central Limit Theorem, point estimation and confidence intervals. Prerequisite: MTH 310 and 341. Offered Sem. I.

### **MTH 442** Mathematical Statistics II **Cr. 3**

Methods of estimating, including method of moments and maximum likelihood. Sufficient statistics, hypothesis testing, power of tests, likelihood ratio tests and introduction to regression and analysis of variance. Prerequisite: MTH 441. Usually offered Semester II, even numbered years.

### **MTH 445/545** Correlation and Regression Analysis **Cr. 3**

An introduction to simple linear regression, multiple regression, polynomial regression. Inferences, appropriateness of model, model diagnostics/adequacy, difficulties in the application of models are discussed. A computer package will be used. Course participants will be involved with hands-on statistical applications and consulting. Prerequisite: MTH 305 or 341. Offered Sem. I, even-numbered years.

### **MTH 446/546** Analysis of Variance and Design of Experiments **Cr. 3**

An introduction to single factor, multiple factor, and randomized block designs in analysis of variance. Inferences, appropriateness of model, model diagnostics/adequacy, difficulties in the application of models are discussed.

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Design or structure of an experiment will be discussed. A computer package will be used. Course participants will be involved with hands-on statistical applications and consulting. Prerequisite: MTH 305 or 341. Offered Sem. II, odd-numbered years.

### **MTH 447/547** Nonparametric Statistics **Cr. 3**

An introductory course presenting the theory and procedures for using distribution-free methods in data analysis. Standard procedures, such as the Wilcoxon tests, Kruskal-Wallis, Kolmogorov-Smirnov, nonparametric confidence intervals, regression analysis, and powers of the tests will be included. Computer programs will be used when appropriate. Prerequisite: MTH 305 or MTH 341. Usually offered Semester II, even numbered years.

### **MTH 448** Operations Research **Cr. 3**

An introductory course which applies mathematics/ statistics to management decision making. Included are methods of optimizing systems, inventory and production control, scheduling, game theory bidding, queuing, quality control, reliability and time series. Various programming, analysis and Monte Carlo techniques are introduced with the computer used as a tool where appropriate. Prerequisites: MTH 305 or MTH 341. Usually offered Semester II, odd numbered years.

### **MTH 449** Applied Multivariate Statistics **Cr. 3**

An introduction to applied multivariate statistical methods covering multivariate analysis of variance, multivariate analysis of covariance, repeated measures design, factor analysis, principle component analysis, cluster analysis, discriminate analysis, and multivariate regression. Course participants will be involved with hands-on statistical applications. MTH 305 or MTH 341. Usually offered Semester I, odd numbered years.

### **MTH 461** Mathematical Physics **Cr. 3**

In depth study of topics from vector analysis, Fourier analysis and special functions with emphasis on modeling physical phenomena involving conservative fields, fluid flow, heat conduction, and wave motion. Prerequisites: MTH 353. (Cross listed with PHY; may only earn credit in MTH or PHY.) MTH 461 may be counted towards both a MTH and PHY major. Offered Sem. II, odd numbered years.

### **MTH 480** Studies in Applied Mathematics **Cr. 3**

Advanced studies of applications of mathematics and computation to solve problems and understand processes from a variety of fields (for example, industry, medicine and the physical and life sciences). Requirements include an application/modeling project with a written report and class presentation. Prerequisite: MTH 353. Usually offered Semester II.

### **MTH 495/695** Special Topics in Mathematics **Cr. 1-3**

Special topics in mathematics not covered by regular courses taught in this department, such as topology, set theory and advanced numerical analysis. The particular topic is decided mutually by the students and instructor. Prerequisite: written consent of the department chair. Repeatable for credit - maximum 6.

### **MTH 496/596** Special Topics in Statistics **Cr. 1-3**

Special topics in statistics not covered by regular courses taught in this department. The particular topic is decided by the instructor.

### **MTH 498** Independent Study **Cr. 1-3**

Directed readings or presentation of material not available in formal departmental courses under the supervision of a faculty member. Prerequisite: written consent of the supervising faculty member and the department chair. Repeatable for credit -- maximum 6.

### **MTH 499** Research Topics **1-3**

An opportunity to pursue individual research topics under the direction of a faculty member. Depending on the

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nature of the research project, study is expected to involve substantial computational or theoretical work in addition to literature review and instruction. In addition to a written report to the supervising faculty member, expected outcomes may include: software, papers and presentations to the department and regional meetings. Prerequisite: written consent of the supervising faculty member and the department chair. Not applicable to a mathematics major or minor. Repeatable for credit -- maximum 6.

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### **SAMPLE SCHEDULES**

The following are sample schedules for two different mathematics majors. Double majors, additional minors and other individual circumstances will affect your own scheduling. You should work with your advisor to plan a schedule that works for you.

See the catalog for additional information on general degree requirements, and as always see your advisor.

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Below is a sample schedule for a student who would like to take a theoretical mathematics track, augmented by a minor in the area of their choice. Students are required either to have a minor, or complete 18 credits at the 300 or 400 level in courses outside the major. Math majors are encouraged to have a minor in a related field such as computer science, physics, chemistry, etc. The exact number of additional courses/credits required will depend upon the minor. If more credits are needed for the minor than are listed below, the free electives may be used to complete the minor requirements.

### Mathematics Major with Minor

<b>Semester 1</b>		<b>Semester 2</b>	
<b>MTH 207 Calculus I</b>	<b>5</b>	<b>MTH 208 Calculus II</b>	<b>4</b>
CHM 103 General Chemistry I	4	<b>MTH 225 Logic and Discrete Math</b>	<b>4</b>
ENG 110 College Writing I	3	CHM 104 General Chemistry II	4
HST 151 World History	3	SPC 110 Health and Well Being	3
<b>TOTAL</b>	<b>15</b>	<b>TOTAL</b>	<b>19</b>
<b>Semester 3</b>	<b>Credits</b>	<b>Semester 4</b>	<b>Credits</b>
<b>MTH 309 Linear Algebra with Differential Equations</b>	<b>4</b>	<b>MTH 310 Calculus III: Multivariate Calculus</b>	<b>4</b>
C-S 120 Software Design I	3	C-S 220 Software Design II	3
PHY 203 General Physics I	4	Gen Ed Elective	4
HST 152 World History	3	Gen Ed Elective (e.g. Min. Cult)	3
Gen Ed Elective (Arts)	2	Gen Ed Elective (Arts)	2
<b>TOTAL</b>	<b>16</b>	<b>TOTAL</b>	<b>16</b>
<b>Semester 5</b>	<b>Credits</b>	<b>Semester 6</b>	<b>Credits</b>
<b>MTH Elective</b>	<b>3</b>	<b>MTH Elective</b>	<b>3</b>
<b>MTH Elective</b>	<b>3</b>	Course for minor	3
Course for Minor	3	Course for minor	3
Gen Ed Elective (e.g. Self/Society)	3	Gen Ed Elective (e.g. Humanistic St.)	3
Ged Ed Elective	3	Free elective	3
<b>TOTAL</b>	<b>15</b>	<b>TOTAL</b>	<b>15</b>
<b>Semester 7</b>	<b>Credits</b>	<b>Semester 8</b>	<b>Credits</b>
<b>MTH 411 Abstract Algebra I</b>	<b>4</b>	<b>MTH 412 Abstract Algebra II</b>	<b>3</b>
<b>(or 407 Real Analysis I)</b>		<b>(or 408 Real Analysis II)</b>	
<b>MTH Elective</b>	<b>3</b>	Free Elective/Courses for minor	<b>8</b>
Course for minor	3		
Free Electives	6		
<b>TOTAL</b>	<b>16</b>	<b>TOTAL</b>	<b>11</b>

**Notes:**

- MTH electives may be chosen freely from the list in the catalog. Some courses with a theoretical emphasis are MTH 331 (modern geometry), MTH 410 (complex analysis), and MTH 413 (topics in linear algebra).
- Courses for the minor and the free electives must include at least 14 credits at the 300/400 level to meet the 40 credit minimum required for graduation. You are encouraged to choose math, computer science, or science courses as free electives.

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Below is a sample schedule for a student who would like to major in Mathematics with Education Emphasis. Additional coursework would be needed for any minor.

### Mathematics Major with Education Emphasis

Semester 1	Credits	Semester 2	Credits
<b>MTH 151 Precalculus</b>	4	<b>MTH 207 Calculus and Analytic Geom.</b>	5
C-S 120 Software Design I	3	BIO 101 Intro to Biological Sci.	4
ENG 110 College Writing I	3	PSY 100 General Psychology	3
HST 151 World History	3	SPC 110 Speech	3
HPR 105 Health and Well Being	3	EFN 205 Under. Human Diff.	3
<b>TOTAL</b>	<b>16</b>	<b>TOTAL</b>	<b>18</b>
Semester 3	Credits	Semester 4	Credits
<b>MTH 208 Calculus II</b>	4	<b>MTH 309 Linear Algebra with Differential Equations</b>	4
<b>MTH 225 Logic &amp; Discrete Math</b>	4	EFN 303 Foundations of Public Ed.	2
EFN 210 Intro. To Education	2	Gen Ed Elective (Science)	4
C-I 211 Level 1 Clinical	1	PSY 311 Adolescent Development	3
ENG 200-206 Literature	3	PSY 370 Educational Psychology	3
Gen Ed Electives (Arts)	2	EDM 317 Educational Media	1
Gen Ed Electives (Arts)	2		
<b>TOTAL</b>	<b>18</b>	<b>TOTAL</b>	<b>17</b>
Semester 5	Credits	Semester 6	Credits
<b>MTH 310 Calculus III: Multivariate Calculus</b>	4	<b>MTH 341 Prob/Stats</b>	4
<b>MTH 311 Number Theory or MTH 317 Graph Theory</b>	3	<b>MTH 331 Modern Geometry</b>	3
C-I 304 Tech. of Classroom Teach.	4	RDG 328	3
C-I 305 Level 2 Clinical	1	SPE 401	3
Gen Ed Elective (Multicul. Studies)	3	EDM 318 Materials Production	1
Gen Ed Elective (Minority Culture)	3	Pol 101 or 102 Government	3
<b>TOTAL</b>	<b>17</b>	<b>TOTAL</b>	<b>8</b>
Semester 7	Credits	Semester 8	Credits
<b>MTH Elective</b>	3	Student Teaching	15
<b>MTH 411 Abstract Algebra I</b>	3	*For those starting in MTH 207, MTH 310 is a good choice for Semester 4	
C-I Methods			
RDG 450 Level 3 Clinical	2		
EFN 460 Middle Level Education	3		
<b>TOTAL</b>	<b>17</b>	<b>TOTAL</b>	<b>15</b>

**Notes:**

- Additional coursework is needed for a minor or double major.
- The following may be required as needed: EFN 200, C-I 381
- A 300 level English course is required if a 'B' or better is not achieved in English
- A 300 level Speech course is required if a 'B' or better is not achieved in Speech 110.
- Other credits/repeats as needed to achieve a 2.75 GPA prior to applying for admission to the Professional Program in Teacher Education as well as prior to Student Teaching.
- The PPST must be passed and your cumulative GPA must be 2.50 or higher to enroll in EFN 210/C-I211.
- Admission to the Professional Program in Teacher Education is a pre-requisite to many of the C-I, RDG and EFN courses listed above; please consult your catalog. For information on the Admission process, please refer to the brochure available in Room 205 Morris Hall.

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Below is a sample schedule for a student who would like to take an applied mathematics track, augmented by a minor in computational science.

### Mathematics Major with a Computational Science Minor

<b>Semester 1</b>		<b>Semester 2</b>	
<b>MTH 207 Calculus I</b>	5	<b>MTH 208 Calculus II</b>	4
<b>CHM 103 General Chemistry I</b>	5	<b>C-S 120 Software Design I</b>	4
ENG 110 College Writing I	3	<b>CHM 104 General Chemistry II</b>	5
HST 101 World History	3	CST 110 Speech	3
<b>TOTAL</b>	<b>16</b>	<b>TOTAL</b>	<b>16</b>
<b>Semester 3</b>		<b>Semester 4</b>	
	<b>Credits</b>		<b>Credits</b>
<b>MTH 309 Linear Algebra with Differential Equations</b>	4	<b>MTH 310 Calculus III: Multivariate Calculus</b>	4
<b>C-S 220 Software Design II</b>	3	<b>MTH 371 Numerical Methods</b>	3
<b>PHY 204 General Physics I</b>	4	<b>PHY 204 General Physics II</b>	4
Gen Ed Elective (e.g. Minority Cult.)	3	Gen Ed Elective (e.g. Humanistic St.)	3
Gen Ed Elective (e.g. Arts – THA 110)	2	Gen Ed Elective (e.g. Arts – ART 102)	2
<b>TOTAL</b>	<b>16</b>	<b>TOTAL</b>	<b>16</b>
<b>Semester 5</b>		<b>Semester 6</b>	
	<b>Credits</b>		<b>Credits</b>
<b>MTH two-course Seq. (e.g. MTH 353)</b>	3	<b>MTH two-course Seq. (e.g. MTH 480)</b>	3
<b>MTH 225 Mathematical Logic</b>	3	<b>MTH Elective</b>	3
<b>C-S Elective</b>	3	<b>CMP 390 Survey of Comp. Science</b>	3
Gen Ed Elective (e.g. Self/Society)	3	HPR 105 Health and Well Being	3
Gen Ed Elective (e.g. Global Studies)	3	Free Elective	3
<b>TOTAL</b>	<b>15</b>	<b>TOTAL</b>	<b>15</b>
<b>Semester 7</b>		<b>Semester 8</b>	
	<b>Credits</b>		<b>Credits</b>
<b>MTH Elective</b>	3	<b>MTH Elective</b>	3
<b>MTH Elective</b>	3	Free Electives	8
<b>CMP 490 Senior Project</b>	3		
Free Electives	6		
<b>TOTAL</b>	<b>15</b>	<b>TOTAL</b>	<b>11</b>

**Notes:**

- You must include at least two writing emphasis courses, at least one of which must be at the 300 level or above. These courses may be in mathematics or outside mathematics. ENG 308 (Technical Writing) is particularly recommended.
- MTH electives may be chosen freely from the list in the catalog. Some courses with an applied and/or computational emphasis are MTH 341 (probability and statistics), MTH 461 (mathematical physics), MTH 311 (number theory), and MTH 317 (graph theory).
- Free electives must include at least 5 credits at the 300/400 level to meet the 40 credit minimum required for graduation. You are encouraged to choose math, computer science, or science courses as free electives.
- Free electives must include at least 5 credits at the 300/400 level to meet the 40 credit minimum required for graduation. You are encouraged to choose math, computer science, or science courses as free electives.

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### Mathematics Major with Actuarial Science Concentration

<b>Semester 1</b>		<b>Semester 2</b>	
MTH 207 Calculus I	5	MTH 208 Calculus II	4
CHM 103 General Chemistry I	4	HST 152 World History	3
ENG 110 College Writing I	3	CHM 104 General Chemistry II	4
HST 151 World History	3	SPC 110 Health and Well Being	3
<b>TOTAL</b>	<b>15</b>	<b>TOTAL</b>	<b>18</b>
<b>Semester 3</b>	<b>Credits</b>	<b>Semester 4</b>	<b>Credits</b>
MTH 309 Linear Algebra with Differential Equations	4	MTH 310 Calculus III: Multivariate Calculus	4
MTH 305 Statistical Methods	3	MTH 341 Probability and Statistics	4
ECO 110 Microeconomics and Public Policy	3	ECO 120 Global Macroeconomics	3
PHY 203 General Physics I	4	Gen Ed Elective (e.g. Min. Cult)	2
C-S 120 Software Design I	3	Gen Ed Elective (Arts)	2
<b>TOTAL</b>	<b>17</b>	<b>TOTAL</b>	<b>16</b>
<b>Semester 5</b>	<b>Credits</b>	<b>Semester 6</b>	<b>Credits</b>
MTH 441 Mathematical Statistics I	3	MTH 442 Mathematical Statistics II	3
ACC 221 Accounting Principles I	3	ACC 222 Accounting Principles II	3
Gen Ed Elective (e.g. Self/Society)	3	MTH Elective	3
Gen Ed Elective	3	Gen Ed Elective (e.g. Humanistics St.)	3
Free Elective	3	Free Elective	3
<b>TOTAL</b>	<b>15</b>	<b>TOTAL</b>	<b>15</b>
<b>Semester 7</b>	<b>Credits</b>	<b>Semester 8</b>	<b>Credits</b>
MTH 445 Correlation and Regression Analysis	3	MTH 446 Analysis of Variance and Design of Experiments	3
FIN 355 Principles of Financial Management	3	Free Electives	8
MTH 440 Statistical Consulting	1		
Free Elective	6		
<b>TOTAL</b>	<b>13</b>	<b>TOTAL</b>	<b>11</b>

**Notes:**

- MTH electives may be chosen freely from the list in the catalog.
- Courses for the minor and the free electives must include at least 14 credits at the 300/400 level to meet the 40 credit minimum required for graduation. You are encouraged to choose math, computer science, or science courses as free electives.

## UW-La Crosse Guide for the Math Major

### Mathematics/Engineering Dual Degree Program

#### Sample Three Year Schedule

<b>Semester I</b> (15 credits) MTH 207 Calculus I (5) PHY 203 General Physics I (4) ENG 110 College Writing (3) HIS 151 World History to 1500 (3)	<b>Semester II</b> (15 credits) MTH 208 Calculus II (4) PHY 204 General Physics II (4) CST 110 Essentials of Speech (3) C-S 120 Software Design I (4)
<b>Semester III</b> (15 credits) MTH 309 Linear Algebra with Differential Equations (4) MTH 225 Mathematical Logic (3) SAH 105 Health and Physical Well-Being (3) ECO 110 Microeconomics and Public Policy (3) ART 102 Art Appreciation (2)	<b>Semester IV</b> (15 credits) MTH 310 Calculus III: Multivariate Calculus (4) MTH 371 Introduction to Numerical Methods (3) ENG 201 American Literature (3) ECO 120 Global Macroeconomics (3) MUS 105 Music Appreciation (2)
<b>Semester V</b> (15 credits) MTH 341 Probability and Statistics (4) MTH 353 Differential Equations (3) CHM 103 General Chemistry I (5) ECO 336 Women in the US Economy (3)	<b>Semester VI</b> (15 credits) MTH 480 Studies in Applied Mathematics or MTH 461 Mathematical Physics (3) CHM 104 General Chemistry II (5) Electives (7)

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Below is a sample schedule for a student **starting with MTH 151 Precalculus** who would like to major in Mathematics (Middle/Secondary Education, grades 5 through 12).

### Mathematics Major with Wisconsin Certification in Early Adolescence through Adolescence

Semester I	Credits	Semester 2	Credits
<b>MTH 151 Precalculus</b>	4	<b>MTH 207 Calculus I</b>	5
PHY 103, 203, 155, 156, ESC 101, CHM 100, 103	4	C-S 120 Software Design I	4
ENG 110 College Writing I	3	ARTS (general education)	2
HST 101 or 102	3	CST 110 Public Oral Communication	3
HPR 105 or SAH 105 or HON 202	3	EFN 205 Under. Human Differences	3
<b>TOTAL</b>	<b>17</b>	<b>TOTAL</b>	<b>18</b>
Semester 3	Credits	Semester 4	Credits
<b>MTH 208 Calculus II</b>	4	<b>MTH 309 Linear Algebra with Differential Equations</b>	4
<b>MTH 225 Math Logic</b>	4	<b>MTH elective</b>	3
EFN 210 Intro. To Education	2	ARTS (general education)	2
C-I 211 Level 1 Clinical	1	GLOBAL/MULTICULTURAL (gen ed)	3
PSY 212 Life Span Development	3	PSY 370 Educational Psychology	3
BIO 103, 105 or MIC 100	4	EFN 303 Foundations of Public Ed.	2
<b>TOTAL</b>	<b>17</b>	<b>TOTAL</b>	<b>17</b>
Semester 5	Credits	Semester 6	Credits
<b>MTH 310 Calculus III: Multivariate Calculus</b>	4	<b>MTH 341 Prob/Stats</b>	4
POL 101, 102	3	<b>MTH 331 Modern Geometry</b>	3
C-I 304 Classroom Practice	4	RDG 328 Reading in Content Area	3
C-I 305 Level 2 Clinical	1	ERS 100, HIS 306, SOC 225, W-S 230	3
SPE 401 Learners with Exceptional Need	3	ENG 200-206, MLB 299 HON 203, 205	3
EDM 319 Technology for Teaching	2		
<b>TOTAL</b>	<b>17</b>	<b>TOTAL</b>	<b>16</b>
Semester 7	Credits	Semester 8	Credits
<b>MTH 411 Abstract Algebra I</b>	4	C-I 403 Student Teaching	15
C-I 364 Curriculum and Methods in Mathematics	3		
RDG 432 Middle Level Reading	3		
EFN 460 Middle Level Education	3		
C-I 450 Level 3 Clinical	1		
<b>TOTAL</b>	<b>14</b>	<b>TOTAL</b>	<b>15</b>

MTH 310, 341, 331 (offered only Semester II) and the math elective may be interchanged but should be completed in Semesters 4, 5 and 6. They may also be interchanged with general education courses taken in Semesters 4, 5, and 6.

Below is a sample schedule for a student **starting with MTH 207 Calculus** who would like to major in Mathematics (Middle/Secondary Education, grades 5 through 12).

## UW-La Crosse Guide for the Math Major

### Mathematics Major with Wisconsin Certification in Early Adolescence through Adolescence

Semester 1	Credits	Semester 2	Credits
<b>MTH 207 Calculus I</b>	5	<b>MTH 208 Calculus II</b>	4
PHY 103, 203, 155, 156, ESC 101, CHM 100, 103	4	C-S 120 Software Design I	4
ENG 110 College Writing I	3	ARTS (General Education)	2
HST 101 or 102	3	CST 110 Public Oral Communication	3
HPR 105 or SAH 105 or HON 202	3	EFN 205 Under. Human Differences	3
<b>TOTAL</b>	<b>18</b>	<b>TOTAL</b>	<b>16</b>
Semester 3	Credits	Semester 4	Credits
<b>MTH 309 Linear Algebra with Differential Equations</b>	4	<b>MTH 310 Calculus III: Multivariate Calculus</b>	4
<b>MTH 225 Math Logic</b>	4	<b>MTH Elective</b>	3
EFN 210 Intro. To Education	2	ARTS (general education)	2
C-I 211 Level 1 Clinical	1	GLOBAL/MULTICULTURAL (gen ed)	3
PSY 212 Life Span Development	3	PSY 370 Educational Psychology	3
BIO 103, 105 or MIC 100	4	EFN 303 Foundations of Public Ed.	2
<b>TOTAL</b>	<b>18</b>	<b>TOTAL</b>	<b>17</b>
Semester 5	Credits	Semester 6	Credits
<b>MTH Elective</b>	3	<b>MTH 341 Prob/Stats</b>	4
POL 101, 102	3	<b>MTH 331 Modern Geometry</b>	3
C-I 304 Classroom Practice	4	RDG 328 Reading in Content Area	3
C-I 305 Level 2 Clinical	1	ERS 100, HIS 306, SOC 225, W-S 230	3
SPE 401 Learners with Exceptional Need	3	ENG 200-206, MLB 299 HON 203, 205	3
EDM 319 Technology for Teaching	2		
<b>TOTAL</b>	<b>16</b>	<b>TOTAL</b>	<b>16</b>
Semester 7	Credits	Semester 8	Credits
<b>MTH 411 Abstract Algebra I</b>	4	C-I 403 Student Teaching	15
C-I 364 Curriculum and Methods in Mathematics	3		
RDG 432 Middle Level Reading	3		
EFN 460 Middle Level Education	3		
C-I 450 Level 3 Clinical	1		
<b>TOTAL</b>	<b>14</b>	<b>TOTAL</b>	<b>15</b>

MTH 310, 341, 331 (offered only Semester II) and the two math electives may be interchanged but taken in Semesters 4, 5 and 6. They may also be interchanged with general education courses taken in Semesters 4, 5, and 6.

## UW-La Crosse Guide for the Math Major

### Notes:

- Individual student schedules may vary from these sample schedules.
- Students are advised to take the PPST during their Freshman Year.
- Students are advised to obtain education-related experiences relating to middle/high school and/or to mathematics education during their Freshman year and subsequent summer. Consult the Mathematics Department and the School of Education's website for more information.
- Students are advised to apply for admission to the School of Education after completing EFN 210 and C-I 211. Using the above schedule, students would apply in the Spring of their Sophomore Year. For information on the Admission process, please consult the website of the School of Education.
- Students should take the Praxis II test after completing all their required mathematics courses with the exception of MTH 411. For example, in the summer before Semester 7 or at the beginning of Semester 7. Passing the Praxis II mathematics test is a requirement for Student Teaching.
- A 300 level English course is required if a 'B' or better is not achieved in ENG 110.
- A 300 level Communication Studies course is required if a 'B' or better is not achieved in CST 110.
- The PPST must be passed and your cumulative GPA must be 2.75 or higher to enroll in EFN 210/C-I 211.
- Admission to the Professional Program in Teacher Education is a pre-requisite to many of the C-I, RDG and EFN courses listed above; please consult your catalog.
- Certain specific general education courses are required. Check with the School of Education for the current list of acceptable courses.
- Prerequisites for Student Teaching are: completion of all requirements in education; grade point averages of 2.75 cumulative, major, minor, concentration, professional sequence coursework; official Praxis II mathematics test score report documenting a passing score.

## UW-La Crosse Guide for the Math Major

### MATHEMATICS FACULTY 2007-08

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## **UW-La Crosse Guide for the Math Major**