

# Mathematics and Statistics

**Department Head:** Russell C. Thompson

**Location:** Lund Hall 211

**Phone:** (435) 797-2809

**FAX:** (435) 797-1822

**E-mail:** mathstat@cc.usu.edu

**WWW:** <http://www.math.usu.edu/>

**Assistant Department Head:** Daniel C. Coster, Lund Hall 301,  
(435) 797-2815, coster@math.usu.edu

**Undergraduate Program Coordinator:** Ian M. Anderson,  
Lund Hall 318, (435) 797-2822, anderson@math.usu.edu

**Graduate Program Coordinator:** D. Richard Cutler,  
Lund Hall 302C, (435) 797-2699, richard@math.usu.edu

**Mathematics Education Program Director:**

James S. Cangelosi, Lund Hall 325C, (435) 797-1415,  
jcang@math.usu.edu

**Undergraduate Advisors:**

**Mathematics:** Chris S. Coray, Lund Hall 310, (435) 797-2861,  
coray@math.usu.edu

**Statistics:** Christopher D. Corcoran, Lund Hall 202,  
(435) 797-4012, corcoran@math.usu.edu

**Degrees offered:** Bachelor of Science (BS), Bachelor of Arts (BA), and Master of Science (MS) in Mathematics; BS and BA in Mathematics Education; BS in Composite Mathematics-Statistics Education; Master of Mathematics (MMath); BS, BA, and MS in Statistics; MS in Industrial Mathematics; Doctor of Philosophy (PhD) in Mathematical Sciences

**Graduate specializations:** *PhD in Mathematical Sciences*—College Teaching, Interdisciplinary Studies, Pure and Applied Mathematics, and Statistics

## Undergraduate Programs

### Objectives

The Department of Mathematics and Statistics offers a variety of programs and courses designed to prepare students for careers in teaching and for positions as mathematicians and statisticians in industry and government. The department also provides service courses for students in many other disciplines and contributes to the University Studies program by providing Quantitative Literacy and Quantitative Intensive classes.

### Placement of New Students

The mathematics ACT score, on-campus placement tests, and Advanced Placement (AP) calculus and statistics scores are used for placement in 1000-level and 2000-level mathematics and statistics courses. New students and students who are registering for

a math class at USU for the first time should have a math ACT score of at least 18 to register for MATH 1010 (Intermediate Algebra), a score of at least 19 to register for STAT 1040, and a score of at least 23 to register for MATH 1030 (Quantitative Reasoning), MATH 1050 (College Algebra), and MATH 1060 (Trigonometry). The alternative to this is to take a placement examination in the Testing Services Office, University Inn 115. **A student who has already taken a math class at USU may register for the next higher level course, providing he or she received a grade of C- or better in the prerequisite course. Equivalent transfer courses must also have a C- or better grade.** Entering students with math ACT scores of less than 18 should register for MATH 0900 (Elements of Algebra) or take the placement examination to qualify for a higher-level course. The placement exam requires a small fee.

A math ACT score of at least 27 is needed to begin in MATH 1100 or 1210.

Entering students with passing scores on AP calculus or statistics exams will be given 8 semester credits in mathematics for passing either one of the calculus exams, and 4 semester credits for passing the statistics exam. Part of this credit may be for specific USU courses. Students with an AP calculus AB score of 3 will generally be advised to start in MATH 1210 (Calculus I). Students with a score of 4 or 5 on the calculus AB exam or a score of 3 or 4 on the calculus BC exam will be given credit for MATH 1210, and will be advised to begin in MATH 1220 (Calculus II). Students with a score of 5 on the calculus BC exam will be given credit for MATH 1210 and 1220, and advised to begin in MATH 2210 (Multivariable Calculus). Students with a score of 3 or higher on the AP statistics exam will be given credit for STAT 2000. Students may also take a placement test in the USU Testing Center to determine if MATH 1100 (Calculus Techniques) or MATH 1210 (Calculus I) is an appropriate place to start.

The calculus courses MATH 1210, 1220, and 2210 are designed for students in mathematics, the sciences, and engineering. MATH 1100 (Calculus Techniques) is designed primarily for students in business and a few other majors. All students in calculus classes need strong backgrounds in the material covered in MATH 1010 and MATH 1050. In addition, the MATH 1210, 1220, 2210 sequence requires trigonometry (MATH 1060) and a graphics calculator.

Students with outstanding mathematics records in high school and transfer students with some experience in calculus may wish to consult with a departmental advisor prior to registration.

### Departmental Admission Requirements

1. New freshmen admitted to USU in good standing qualify for admission to the major.

2. Transfer students from other institutions need a 2.2 transfer GPA, and students transferring from other USU majors need a 2.0 total GPA for admission to this major in good standing.

3. Students may be admitted to the Mathematics Education major by satisfying either of the above conditions. However, in order to be admitted to the Secondary Teacher Education Program (STEP), and to graduate from the Mathematics Education major

(and minor), students must have a cumulative GPA of at least 3.0 in the equivalent of MATH 1210, 1220, and 2210, and an overall GPA of at least 2.75.

### University Requirements

All students in the Department of Mathematics and Statistics must satisfy the requirements of USU's University Studies program, described on pages 42-49 of this catalog.

### College of Science Requirements

Every bachelor's degree candidate in the College of Science must complete the following coursework or its equivalent:

1. One year of calculus: MATH 1210 and 1220. In some degrees or emphases within degrees, the second semester of calculus may be replaced by STAT 3000. The substitution will be for specific degree programs, not by student choice.

2. One of the following year-long sequences: BIOL 1210, 1220; CHEM 1210, 1220; GEOL 1150, 3200; PHYX 2110, 2120; PHYX 2210, 2220. The chosen sequence must be *outside the student's major department*.

### Bachelor of Arts (BA) Degree

For this degree, students must complete the major requirements for the corresponding BS degree, plus the equivalent of two years of training in a foreign language. The Languages, Philosophy, and Speech Communication Department is responsible for approving the foreign language coursework for this degree.

### Major Requirements

Major and minor requirements in the Department of Mathematics and Statistics vary from time to time. Students may obtain from the department information about the exact requirements in effect at any given time. All grades for MATH and STAT courses applied toward a departmental major or minor must be C- or better. Major and minor requirements in effect at the beginning of Fall Semester 2004 are given below.

**Mathematics Major.** MATH 1210, 1220, 2210, 2270, 2280, 4200, 4310, 5210, and 5710; any two courses (6 credits) from MATH 5110, 5220, 5270, 5310 (or 5340), and 5510; any three additional courses (9 credits) in mathematics at the 5000-level, excluding Actuarial Mathematics (MATH 5570, 5580). Note: MATH 2250 may substitute for both MATH 2270 and 2280; however, MATH 2270 and 2280 are recommended. Several options in this major exist (e.g., Actuarial Science, Computational Math, and dual Majors with Computer Science, Physics, and Electrical Engineering). Contact the Mathematics and Statistics Department for details.

**Mathematics Education Major.** STAT 1040; MATH 1210, 1220, 2210, 2250, 3110, 4200, 4310, 4400, 4620, 5500, and 5710; *Secondary Teacher Education Program (STEP)*: Level 1—SCED 3100, 3210, MATH 3300, 4500; Level 2—SPED 4200, 4210, SPED 4000, MATH 4300; Level 3—SCED 5500, 5630. Admission to the STEP requires a GPA of at least 3.00 in the equivalent of MATH 1210, 1220, and 2210, and an overall GPA of at least 2.75. Graduation from this major also requires an overall GPA of at least 2.75. No more than three repeats in *all* required courses may be used in GPA computations. The STEP is normally completed during the last three semesters of the degree program, and

consequently nearly all the mathematics classes in the Mathematics Education Major must be completed before beginning the STEP.

**Composite Mathematics-Statistics Education Major.** MATH 1210, 1220, 2210, 2250 or 2270, 3110, 4200, 4310, 4400, 4620, 5500, 5710, STAT 1040, 2000 or 3000, 5100, 5200, 5890; *Secondary Teacher Education Program (STEP)*: Level 1—SCED 3100, 3210, MATH 3300, 4500, STAT 4500; Level 2—SPED 4000, SCED 4200, 4210, MATH 4300; Level 3—SCED 5500, 5630. Admission to the STEP requires a cumulative GPA of at least 3.00 in the equivalent of MATH 1210, 1220, 2210 and a cumulative GPA of at least 3.00 in STAT 1040, 2000 or 3000, and an overall GPA of at least 2.75. No more than three repeats in all required courses may be used in GPA computations. The STEP is mostly completed in the last three semesters of the degree program.

**Statistics Major.** MATH 1210, 1220, 2210, 2270, 4200, 5710 and 5720; CS 1700; STAT 2000 or 3000; STAT 4920, 5100, 5200, 5890; any three additional statistics classes (9 credits) at the 5000-level. One of the three additional classes may be selected from MATH 4630, 5570, 5610, and 5760. Note: MATH 2250 may substitute for MATH 2270.

### Emphasis Requirements

**Computational Mathematics Emphasis.** This emphasis, available in the Mathematics Major, requires the following: MATH 1210, 1220, 2210, 2270, 2280, 3310, 4200, 5210, 5610, 5620, and 5710; two courses (6 credits) in mathematics at the 4000-level or above, not including Actuarial Mathematics (MATH 5570, 5580); CS 1700, 1710, 1720, 2200, and 2370; any two computer science courses numbered above 4000. Note: MATH 2250 may substitute for MATH 2270 and 2280. MATH 4620 *may not* be counted towards the elective mathematics credit requirement. Students who complete the computer science coursework with a GPA of at least 2.5 automatically earn a minor in computer science.

**Actuarial Science Emphasis.** This emphasis, available in *either* the Mathematics Major *or* the Statistics Major, requires the following for Mathematics majors: MATH 1210, 1220, 2210, 2270, 2280, 4200, 4310, 5210, 5570, 5580, 5710, 5720; STAT 2000 or 3000; STAT 5100; CS 1700; ACCT 2010; ECON 2010; BA 3400; and one business administration course (3 credits) numbered above 4000. Statistics majors should complete STAT 5200 and one 5000-level STAT elective *instead of* MATH 4310 and 5210. Note: MATH 2250 may substitute for MATH 2270 and 2280. Admission to this emphasis requires explicit departmental approval.

### Dual Major Requirements

Students who are interested in two or more major areas (in different departments) should consult with a departmental advisor to discuss the possibility of an individually designed degree program. Such programs typically entail completing major requirements in two or more departments, but cooperating departments may agree to waive some requirements in each department to facilitate a dual or triple major.

By meeting requirements for any two separate majors, USU students may earn a **dual major**, meaning *one bachelor's degree* in the *combination* of two approved majors. Students majoring in

Mathematics may benefit from combining their major with a Computer Science, Electrical Engineering, Physics, or Statistics major. Following are the requirements for each of these dual majors.

**Mathematics-Computer Science.** MATH 1210, 1220, 2210, 2250 (or 2270 and 2280), 3310, 4200, 5210, 5610, 5620, 5710; CS 1700, 1710, 1720, 2200, 2370, 2550, 2560, 3000, 3100, 4700, 5000 or 5050; SPCH 1050; one of PHIL 2400, 2500, 3520, or 4540; 13 credits from the following list: CS 5000, 5050, 5100, 5200, 5300, 5370, 5400, 5450, 5600, 5650, 5700, 5800, 5850, 5890, 5950 (note that CS 5000 and 5050 may not be double counted); SPCH 1050; one of the following sequences: PHYX 2210, 2220 *or* BIOL 1210, 1220, *or* CHEM 1210, 1220, 1230, 1240 *or* GEOL 1150, 3200, plus one additional computer science advisor-approved science course so that the total in this sequence section is at least 13 credits; plus one additional University Studies class (3 credits) from the BAI, BHU, BSS, or BCA approved lists.

**Mathematics-Electrical Engineering Major.** All courses in the Electrical Engineering major; MATH 1210, 1220, 2210, 2250, 4200, 4310, 5210, 5710; and three additional courses (9 credits) in mathematics numbered above 4600, excluding MATH 5570 and 5580. Note: Only one of MATH 4620 and 4630 may count towards the elective credit in mathematics.

**Mathematics-Physics Major.** MATH 1210, 1220, 2210, 2270, 2280, 4200, 4310, 5210, 5710; PHYX 2210, 2220, 2710, 3550, 3600, 3650 or 3700, 3870, and 4900; two additional courses in mathematics numbered above 4600; 8 additional credits in physics numbered above 3500, excluding University Studies Depth courses. Note: MATH 2250 may substitute for MATH 2270 and 2280. MATH 4620 *may not* count towards the elective credit in mathematics. PHYX 2110 and 2120 may substitute for PHYX 2210 and 2220.

**Mathematics-Statistics Major.** MATH 1210, 1220, 2210, 2270, 2280, 4200, 4310, 5210, 5710, and 5720; STAT 2000 or 3000; STAT 5100, 5200, 5890; CS 1700; at least two mathematics courses (6 credits) numbered above 5000; at least two statistics courses (6 credits) numbered above 5000. Note: MATH 2250 may substitute for MATH 2270 and 2280. Either MATH 5570 or 5760 may substitute for one of the statistics elective courses.

### Minor Requirements

**Mathematics Minor.** MATH 1210, 1220, 2210, 2270, 2280; two courses (6 credits) in mathematics numbered above 4000, excluding MATH 4300, 4400, 4500, and 4620. Note: MATH 2250 may substitute for MATH 2270 and 2280.

**Statistics Minor.** STAT 2000 or 3000; STAT 5100, 5200; two courses (6 credits) from statistics courses numbered above 5000 or from MATH 5710, 5720, and 5760.

**Mathematics Education Minor.** STAT 1040; MATH 1210, 1220, 2210, 2250, 3110, 4200, 4310, 4400, 4500, 4620, 5500, 5710; Secondary Teacher Education Program (STEP) for the student's Secondary Education major. Admission to the STEP requires a GPA of at least 3.00 in the equivalent of MATH 1210, 1220 and 2210, and an overall GPA of at least 2.75. Graduation from this minor also requires an overall GPA of at least 2.75. No more than three repeats in *all* required courses may be used in GPA computations. The STEP is normally completed during the

last three semesters of study, and consequently nearly all the mathematics classes in the Mathematics Education Minor must be completed before beginning the STEP.

**Biomathematics Minor.** BIOL 1210, 1220; MATH 1210, 1220, 2270, 2280; STAT 3000; MATH/BIOL 4230. (Note: MATH 2250 may substitute for MATH 2270 and 2280.) Biology majors must take one course from the biology electives (listed below), and two courses from the mathematics and statistics electives (listed below). Mathematics and Statistics majors must take two courses from the biology electives, and one course from the mathematics and statistics electives. All other majors must take two courses from each set of electives. *Biology Electives:* BIOL 5170, 5200, 5600, 5620; PUBH 5330; FRWS 3400; BMET 5500. *Mathematics and Statistics Electives:* MATH 4630, 5410, 5420, 5460, 5610, 5620, 5710; STAT 5100, 5110, 5120, 5200, 5300, 5600.

### Additional Information

Students who enter the University with AP credit in Mathematics and/or Statistics, and about 30 additional AP or CLEP credits, may be able to complete both a BS and an MS degree within five years or less. Interested students should consult with a departmental undergraduate advisor.

### Financial Support

The department offers several one-, two-, and four-year scholarships to qualified students who enroll as full-time Mathematics, Mathematics Education, or Statistics majors. The winner of the Hunsaker Scholarship receives a cash award each semester for two years. This award is given in addition to any four-year scholarship or tuition waiver for which the student is eligible. During the final two years, the recipient is expected to work as a grader or tutor for the department. The department also offers other scholarships (Elich, Ellis, van Vliet, and departmental). The amount of these scholarships varies from year to year. The Ellis Scholarship is awarded to a junior or senior Mathematics Education major, and the recipient is selected by the department. To apply for any of these scholarships (except for the Ellis Scholarship, for which there is no application) send a statement of qualifications, including high school transcripts and SAT or ACT scores, and three letters of recommendation to:

Scholarship Committee  
Department of Mathematics and Statistics  
Utah State University  
3900 Old Main Hill  
Logan UT 84322-3900

Applications must be received by April 1.

## Graduate Programs

### Admission Requirements

See the general admission requirements for graduate programs at Utah State University on pages 90-91 of this catalog. In general, students wishing to pursue graduate studies in mathematics or statistics should have a bachelor's degree in mathematics, statistics, or a closely related field, with extensive coursework in one of the departmental disciplines.

Students entering the Master of Mathematics (MMath) program must either possess a valid secondary school teaching license or be concurrently enrolled in a secondary school teacher licensure program.

### ***Degree Programs***

**Master of Science (MS).** The department offers MS programs in mathematics and statistics. This degree is a terminal degree for most students, but is also a “stepping stone” for students who ultimately wish to pursue a doctorate in mathematics or statistics.

**Master of Mathematics (MMath).** This program is designed specifically for secondary school teachers of mathematics. The purpose of this degree is to provide students with a broad background in mathematics.

**Master of Science (MS) in Industrial Mathematics.** The Industrial Mathematics master’s degree is designed to broaden the learning experiences and job opportunities for master’s students in mathematics. The program of study incorporates fundamental applied mathematics and interdisciplinary coursework in support of an industrial internship experience.

**Doctor of Philosophy (PhD) in Mathematical Sciences.** This is a terminal degree for mathematics and statistics researchers in academe, government, and industry, as well as for prospective college teachers.

### ***Specializations for PhD in Mathematical Sciences***

The **College Teaching Specialization** is designed to prepare students to teach undergraduate mathematics in two- and four-year colleges and in universities. This program is less specialized than the other two options. Students in the College Teaching specialization receive broad training in pure and applied mathematics. The dissertation for this specialization includes exposition of important mathematical theories and their historical relationships in an area of mathematics of the student’s choosing.

The **Interdisciplinary Studies Specialization** offers advanced training in mathematics as a research tool. The mathematical component emphasizes areas of applied mathematics. In addition, the student receives graduate-level training in the chosen area of application. The student’s course of study and research is directed both by scholars in mathematics and by scholars in the related discipline. The dissertation involves the development and application of mathematics in the context of research problems arising in the chosen interdisciplinary area.

The **Pure and Applied Mathematics Specialization** is a traditional doctoral program in mathematics, offering broad training in the foundations of modern mathematics together with specialized training in an area of mathematical research. The dissertation represents a significant contribution to mathematics research in the chosen area of specialization.

The **Statistics Specialization** offers broad training in theoretical and applied statistics for students seeking careers in academia, industry, or government. The dissertation represents a significant contribution to statistical research.

### ***Course Requirements***

Departmental requirements change from time to time. Check with the Department of Mathematics and Statistics for the list of requirements currently in effect. The requirements listed below are in effect for Fall Semester 2004.

**Master of Science in Mathematics.** This degree requires 30 credits of approved coursework at or above the 5000 level. At least 18 of these credits must be at the 6000 level or above, excluding MATH 6990 and 7990 (Continuing Graduate Advisement) and MATH 7910 (College Teaching Internship). Generally, most of the coursework will be in mathematics, but the student’s supervisory committee may approve courses in statistics, physics, engineering, or any other discipline, if it seems such coursework is appropriate for the student’s program of study.

The MS in mathematics has three options. The Plan A or the thesis option requires taking 6 credits of MATH 6970 (Thesis and Research) and working with a faculty member on a substantial research project. The research must be presented in a thesis, which must be approved by the student’s supervisory committee and the dean of the School of Graduate Studies. An oral defense of the thesis must be arranged through the School of Graduate Studies.

The Plan B or project option requires taking 3 credits of MATH 6970 and working with a faculty member on a smaller research project. A written report of the research must be approved by the student’s supervisory committee. An oral defense of the report must be scheduled through the School of Graduate Studies.

The third option of the MS in Mathematics requires only coursework, and is called the Plan C option.

All students in the MS program in Mathematics must pass a written qualifying examination covering the introductory analysis and advanced calculus material presented in MATH 4200, 5210, and 5220. Students may take this exam before beginning formal coursework in the MS program, and must take the exam at the end of the first full year of matriculation. The exam is typically given twice a year, in May and September. Matriculated students who fail on their first try must pass the exam at the next scheduled opportunity. A detailed exam syllabus is contained in the *Graduate Handbook*, available from the department.

**Master of Science in Statistics.** This degree requires 30 credits of approved coursework at or above the 5000 level. At least 18 credits must be at the 6000 level or above, excluding STAT 6990 and STAT 7990 (Continuing Graduate Advisement). All students must take STAT 6710 and 6720 (Mathematical Statistics I and II). Generally, most of the coursework will be in statistics, but the student’s supervisory committee may approve courses in mathematics, biology, economics, or any other discipline if it deems such coursework to be appropriate for the student’s program of study.

The MS in statistics has Plan A (thesis), Plan B (report), and Plan C (coursework only) options. The Plan A and Plan B options require students to work with a faculty member on a research project, taking 6 or 3 credits of MATH 6970, respectively, and presenting the results of the research in a written report. For both the Plan A and Plan B options, the report must be approved by the student’s supervisory committee. A Plan A report (thesis) must also be approved by the dean of the School of Graduate Studies. Both Plan A and Plan B reports require an oral defense that must be scheduled through the School of Graduate Studies.

Students in all three options of the MS in Statistics must pass a written qualifying examination based on the material presented in STAT 3000 (Statistics for Scientists), MATH 5710 (Introduction to Probability), and MATH 5720 (Introduction to Mathematical Statistics). Students may take the exam before beginning any formal coursework in the MS program. Students must attempt the exam by the end of the first full year of matriculation. The exam is usually given in late May and early August each year. Matriculated students who fail the exam on their first try must pass the exam at the next scheduled opportunity. A detailed exam syllabus is available in the *Graduate Handbook*, available from the department.

**Master of Mathematics.** This program requires at least 36 credits approved by the Graduate Committee within the Department of Mathematics and Statistics. At least 21 of these credits must come from mathematics classes numbered above 5000. MATH 4620 or an approved substitute must also be included. The GPA for the 36 credits and for the 21 math credits must be at least 3.0.

**Master of Science in Industrial Mathematics.** This degree requires 36 credits of coursework at or above the 5000 level. At least 15 of these credits must be completed in MATH courses at the 6000 level or above. Additionally, students must complete a total of 9 credits outside of Mathematics which complement their internship and final project. A maximum of 3 of these credits may be taken at the 5000-level (i.e., one 3-credit course in another department). See the departmental website or the *Graduate Handbook* for more detailed information about coursework requirements.

Students are required to pass the Advanced Calculus examination (see the Master of Science in Mathematics examination requirements), *or* the Statistics qualifying examination (see the Master of Science in Statistics examination requirements), *or* an examination based on material presented in four core courses chosen by the student during the first year. The exam, which can be taken before or at the beginning of the student's second year in the program, is usually given in late May or early August. Students are also required to complete a final project based on work done during an internship, either with a company or possibly with another department on campus. The project will include a technical write-up suitable to the industry/field, and presentation to the involved faculty and students in the program. This follows the Plan B option listed for the Master of Science in Mathematics degree.

The Departmental Graduate Committee supervises all MS and MMath students until a supervisory committee for the student is established and approved. Prior to advancement to candidacy, students in Plan A and Plan B options for the MS degree in mathematics and statistics must pass an examination in English writing. This exam is administered by the Department of Mathematics and Statistics.

**PhD in Mathematical Sciences.** In all the doctoral specializations, a course of study consists of 90 credits beyond a bachelor's degree or 60 credits beyond a master's degree. The minimal course requirements described below assume that the student needs 90 credits. In all specializations, credit may be earned toward a master's degree, as part of the 42 required credits (see below), but coursework cannot be applied to two degrees. The complete course of study must be approved by the student's supervisory committee.

**College Teaching Specialization.** Seven course sequences (42 credits) in mathematics courses numbered 6000 and above, excluding MATH 7970 and including at least 6 credits in seminars and topics courses in mathematics at the 7000 level and 6 credits of MATH 7910 (College Teaching Internship), are required.

**Interdisciplinary Studies Specialization.** Forty-two (42) credits in courses numbered 6000 and above, excluding MATH 7970 and including at least four course sequences (24 credits) in mathematics, 6 credits in seminars and topics courses in mathematics at the 7000 level, and approved courses in the student's interdisciplinary area, are required.

**Pure and Applied Mathematics Specialization.** Seven course sequences (42 credits) in mathematics courses numbered 6000 and above, excluding MATH 7970 and including at least 6 credits in seminars and topics courses at the 7000 level, are required.

**Statistics Specialization.** Seven course sequences (42 credits) in mathematics or statistics in courses numbered 6000 and above, excluding MATH 7970 and STAT 7970 and including at least 6 credits in seminars and topics courses at the 7000 level, are required.

### *Common Degree Requirements*

For all students in the **Pure and Applied Mathematics**, the **Interdisciplinary Studies**, and the **Statistics** specializations, a maximum of 30 credits of MATH 7970 (Dissertation Research) is allowed. Students in the **College Teaching** specialization are allowed a maximum of 20 credits of MATH 7970.

In addition to completing the coursework requirements, PhD students must:

1. Demonstrate competency in advanced calculus.
2. Pass a written PhD *qualifying* examination. For students in the **College Teaching** and **Pure and Applied Mathematics** specializations, the examination is on Real Analysis. For students in the **Statistics** specialization, the examination will be on Probability and Mathematical Statistics. Students in the **Interdisciplinary Studies** specialization may take the qualifying exam in Real Analysis *or* the exam in Probability and Mathematical Statistics, depending on the emphasis of their coursework within the Department of Mathematics and Statistics.
3. Pass a PhD comprehensive examination that is constructed by the student's committee. This examination may have written or oral components, or both, and may require a student to prepare and defend a report.
4. Successfully complete an examination in English writing skills. Often this exam will be the student's dissertation research proposal.
5. Complete a dissertation.
6. Pass a final oral examination defending the dissertation and demonstrating a general knowledge of core mathematics or statistics.

### *Research*

Mathematics research opportunities within the department are many and varied, and students are urged to contact faculty about mutual interests at as early a stage as feasible. The interdisciplinary option permits and encourages study with a broad spectrum of outstanding nationally recognized University research programs.

### **Financial Assistance**

The department offers full-time teaching assistantships, half-time paper-grading assistantships, research fellowships, and work-study assistance for students in all graduate degree programs. Stipends vary from \$6,500 for a half-time paper-grading assistantship to \$13,000 for teaching assistants pursuing a master's degree. Stipends for PhD students range from \$14,000 for incoming students to \$16,000 for students who have passed all required comprehensive examinations. Normally, a teaching assistant has responsibility for a single course each semester. Out-of-state tuition waivers are usually given with each full-time teaching or half-time paper-grading assistantship. All tuition is usually waived for PhD students. Applications for teaching assistantships should be mailed by March 1 of each year.

## **Mathematics and Statistics Faculty**

### **Professors**

*Ian M. Anderson*, differential geometry, global analysis  
*LeRoy B. Beasley*, matrix theory, linear algebra, combinatorics  
*James S. Cangelosi*, mathematics education  
*Lawrence O. Cannon*, topology, mathematics education  
*Chris S. Coray*, numerical analysis  
*E. Robert Heal*, analysis, statistics, mathematics education  
*Lance L. Littlejohn*, differential equations, special functions  
*James Powell*, applied mathematics, mathematical biology  
*David H. Sattinger*, differential equations  
*Russell C. Thompson*, differential equations  
*Zhi-Qiang Wang*, nonlinear differential equations, nonlinear analysis  
*Stanley C. Williams*, measure theory, modern analysis

### **Professors Emeriti**

*Ronald V. Canfield*, multivariate and industrial statistics  
*Duane Loveland*, geometric topology, continuum theory  
*Jerry Ridenhour*, differential equations  
*Donald V. Sisson*, statistical methods, experimental design  
*David White*, categorical data analysis

### **Associate Professors**

*Daniel C. Coster*, experimental design, linear models  
*Adele Cutler*, statistical computing  
*D. Richard Cutler*, statistics, computational fluid dynamics  
*Mark E. Fels*, differential geometry  
*Joseph V. Koebbe*, numerical analysis, applied mathematics  
*Michael C. Minnotte*, nonparametric density estimation, statistical visualization  
*Xiaofeng Ren*, partial differential equations, applied mathematics  
*Emily F. Stone*, dynamical systems  
*Kathryn Turner*, numerical analysis, optimization, linear algebra  
*Dariusz M. Wilczynski*, geometric and algebraic topology

### **Associate Professors Emeriti**

*Wayne R. Rich*, mathematics education  
*E. Eugene Underwood*, matrix theory, linear algebra  
*James D. Watson*, numerical analysis

### **Assistant Professors**

*Christopher D. Corcoran*, biostatistics and computational statistics  
*Piotr Kokoszka*, probability and time series analysis  
*Juergen Symanzik*, computational and graphical statistics  
*M. K. Stephen Yeung*, dynamical systems, gene network structures

### **Principal Lecturer**

*David D. Bregenzner*, mathematics, statistics

### **Senior Lecturer**

*Eric Rowley*, mathematics, mathematics education

### **Lecturers**

*Bryan Bornholdt*, mathematics, mathematics education  
*Claudia Mora*, mathematics, mathematics education

## **Course Descriptions**

Mathematics (MATH), pages 434-437  
Statistics (STAT), pages 487-488