WESTERN MICHIGAN UNIVERSITY

DEPARTMENT OF MATHEMATICS

GRADUATE STUDENT HANDBOOK

(REVISED April 2021)

I. FACTS ABOUT WESTERN MICHIGAN UNIVERSITY AND THE MATHEMATICS DEPARTMENT

Western Michigan University is a dynamic, student-centered research university with an enrollment of over 21,000. WMU is focused on delivering high-quality instruction and fostering significant research activities.

Undergraduate students at WMU may choose from more than 140 program offerings while graduate students may select from 74 master's, one specialist, 31 doctoral programs, and 10 graduate certificates. A number of programs at both the undergraduate and graduate levels have attained national recognition. Also enriching the quality of campus life are over 400 registered student organizations and a full array of NCAA Division IA intercollegiate athletic teams.

The University's commitment to the discovery and dissemination of new knowledge and insight has resulted in initiatives that reward faculty and student research, scholarship and creative activity. In a typical year, WMU faculty and staff conduct $30 to $40 million in externally funded research on topics ranging from nuclear physics and specialized education to developing technology that enables more efficient flight and more environmentally friendly public transportation. Instructional programs are designed to increase students' capacity for learning and service to society, as well as meet the needs of an increasingly diverse student population.

WMU is Michigan's fourth largest higher education institution, attracting a diverse and culturally rich student body from across the United States and over 100 other countries. Its nearly 900 full-time faculty members have been trained at some of the world's finest institutions and they bring to the University a global perspective that enhances the learning environment.

Western Michigan University's campuses encompass 1,313 acres and 150 buildings. Its main campus, close to downtown Kalamazoo, features some of the finest instructional and performance facilities in the Midwest as well as residence halls equipped to house more than 5,700 students. The University's College of Engineering and Applied Sciences and the Business Technology and Research Park are located three miles away on the Parkview Campus, while its nationally recognized College of Aviation is based at the W.K. Kellogg Airport in nearby Battle Creek. Among WMU's newest instructional centers are the College of Health and Human Services building, the Chemistry Building, and Sangren Hall, each a state-of-the-art facility that houses specialized research labs, classrooms and lecture spaces, and faculty office space. Western also has an affiliated professional school, the Homer Stryker M.D. School of Medicine in downtown Kalamazoo.

Founded in 1903, WMU rapidly grew from a regional teachers college to an internationally regarded institution of higher education. What was once Western Michigan College became Western Michigan University in 1957, when the state designated it as the fourth public university in Michigan.

The Department of Mathematics is one of the twelve original departments of Western State Normal School. Its first chair was John P. Everett, for whom Everett Tower is named. Paul Rood was the first chair of the Physics Department. The Department of Mathematics has four undergraduate

majors: applied mathematics, general mathematics, elementary and middle school mathematics, and teaching and learning of mathematics. There are four undergraduate minors: general mathematics, actuarial science, elementary and middle school mathematics, and teaching and learning of mathematics. The Department offers three master's programs: MA in mathematics and in mathematics education, and MS in applied math. There are two doctoral programs, one in mathematics and one in mathematics education. Within the doctoral program for mathematics education, there are specializations for K-12 and for collegiate mathematics education. The mathematics doctoral program was introduced in 1968 and is one of the oldest at WMU. The doctoral program in mathematics education began in 1988.

The Mathematics Department is a small, friendly community with open and accessible professors. Our graduate students receive a considerable amount of individualized attention and encouragement from the faculty. Being a graduate student at WMU provides opportunities to gain experience in teaching, supervising undergraduate research, and interning with local firms. Our graduate experience provides a student with well-rounded career training.

Graduate students from Western Michigan University have been very successful in finding employment and are well prepared for a career in academia, business, and other institutions. A recent report by the Society for Industrial and Applied Mathematics (SIAM) indicates about 25% of math Ph.D.'s and 44% of master's graduates have positions in either government or industry. Mathematicians are sought because of their ability to think analytically, deal with complexity, develop models, and formulate and solve problems. Mathematicians are employed by companies in engineering research, computer services, software, electronics, aerospace, transportation, insurance, financial services, chemistry, pharmaceuticals, and others. A list of all students who have received doctorates from the WMU Department of Mathematics and their initial or current employers is given in Appendix A.

II. ORGANIZATION OF THE DEPARTMENT

The Department Chair has the administrative responsibility for the Department and is the official representative of the Department to the University. The current Chair is Dr. Steve Ziebarth.

The Chair is assisted by two Associate Chairs who jointly coordinate the work of the Instruction Committee, one of six standing committees within the Department. Work within the Department is also guided by three elected faculty members who serve for three-year rotating terms on the Executive Committee. Although the majority of the policies and major decisions are made by the entire Department, discussions and recommendations for administrative policies are usually initiated by the Executive Committee. Ex officio members of the Executive Committee are the Chairs of the Assessment, Curriculum, and Graduate Committees. The Assessment Committee collects and analyzes data on Department programs in order to improve those programs.Policies of concern to the graduate and undergraduate programs are primarily initiated in the Curriculum Committee. The Instruction Committee is responsible for appointing and overseeing the teaching performance of teaching assistants. Graduate students should refer all questions and matters of concern regarding the assignment of their teaching duties to an Associate Chair.

The Graduate Committee is responsible for overseeing all parts of the academic performance of graduate students. The Graduate Committee also handles all requests for exceptions to Department policy related to graduate programs. Graduate students should refer all questions and matters of concern regarding their academic standing and program progress first to their program advisors. Depending upon the situation, they may be referred to the Chair of the Graduate Committee to present their concerns.

The Recruitment, Awards, Scholarships and Competitions Committee determines recipients of the undergraduate and graduate awards as well as the undergraduate scholarships. Department mathematics competitions are handled by this committee, as well as recruitment of undergraduate and graduate students.

III. ORGANIZATION OF EVERETT TOWER AND ROOD HALL

Departmental Classrooms

Departmental classrooms are generally located in Rood Hall. Classrooms in Sangren Hall, Schneider Hall, Knauss Hall, Brown Hall, and Wood Hall are also used. Occasionally seminar rooms in Everett are used for graduate courses.

Departmental Offices

The Departmental offices are located in the central portion of the third floor of Everett Tower. The administrative assistants to the chair are Ms. Sue Simons (3318 Everett) and Mr. Steve Culver (3322 Everett). Mr. Culver works with the Associate Chairs in making teaching assignments each term. The Graduate Programs Assistant is Ms. Elizabeth Roe (3303 Everett). The Directors of the Department's Developmental Mathematics Program (Math 1090, 1100, and 1110) are Dr. Kirsty Eisenhart (3326 Everett) and Ms. Thayma Lutz(3328 Everett).

The main Departmental office is 3319 Everett Tower. Faculty, Graduate Student, and Instructor mailboxes, along with support staff, are located here. This office is typically open Monday through Friday from 8 a.m. to noon, and from 1 p.m. to 5 p.m. Offices are closed when the University is closed and students should consult the official Western Michigan University calendar for dates of closure each semester. However, administrative offices are often open when classes are not in session (e.g., exam weeks, certain semester break weeks).

Faculty Offices & Conference Rooms

Faculty offices are on floors 3 through 6 of Everett Tower. There are conference rooms on some floors. They can be reserved for things such as giving a make-up test or for a review session. The conference rooms can only be used for studying when they are not needed for other activities. The Alavi Commons Room on the 6th floor is the location of most seminars and colloquia.

IV. RESOURCES AND OPPORTUNITIES

Waldo Library

Western Michigan University maintains a large collection of mathematical research literature. Extensive holdings allow for direct access to original sources. Ongoing acquisitions and subscriptions (over 200 major world-wide mathematical journals) keep the collection up to date. This collection is housed in Waldo Library and is also accessible at https://wmich.edu/library. The library also provides extensive electronic resources, such as data bases for journal articles, several online search engines, and interlibrary loans.

University Computing Services

University Computing Services is located in the building connected to Waldo Library. It has a large computer lab and walk-in technical support desk. The Department has several workstations for advanced graduate work and research as well as computers for the use of faculty and students use (both undergraduate and graduate) in the Arts and Sciences Computer Lab located on the 3rd floor of Rood Hall.

Professional Society Memberships

Graduate students are eligible for free membership in SIAM (Society for Industrial and Applied Mathematics). Membership in such an organization provides a window to the field of mathematics outside WMU. Additional benefits include discounts on books and deeply discounted or free subscriptions to journals. For further information and a link to the application form go to http://www.siam.org/students/memberships.php.

Math Club and Math Honors Society

The Math Club organizes a variety of events including mathematical talks and social gatherings. Events are free and open to all. A schedule can be found at http://www.wmich.edu/mathclub/calendar.html. Students are encouraged to give talks accessible to undergraduate and graduate mathematics students. See the website for current faculty advisors.

The Department is also home to the Michigan Epsilon Chapter of Pi Mu Epsilon (PME), a national honorary mathematics society. Students can check if they are eligible for membership at http://www.wmich.edu/mathclub/pmeeligibility.html. Applications are solicited twice per year during the fall and spring semesters. An induction ceremony and banquet follow each selection of successful applicants.

Graduate Student Representative

The Graduate Student Representative in the Department of Mathematics at Western Michigan University is a senior doctoral graduate student from the Department. The Graduate Student Representative serves as the voice of graduate students by being a member of the Department Graduate Committee. Other responsibilities include organizing graduate student seminars and

other opportunities for developing a sense of community among the Department graduate students. The Graduate Student Representative advocates for the Department graduate students by being someone they can contact about their experiences in the Department and through representing their concerns and interests at the Graduate Committee meetings. In particular, they make a concerted effort to reach out to new graduate students to provide mentoring as they begin their journeys. Information shared by a graduate student with the Graduate Student Representative is confidential unless a safety concern is present or there is a legal obligation to report the information. In the spring term of each year, senior doctoral graduate students will be solicited to provide a statement of interest in this position. A student will be chosen by the Graduate Committee and Instruction Committee. The Graduate Student Representative receives a supplemental stipend for their work.

Awards

There are several awards (described below) given annually by the Department to recognize graduate students for excellence in teaching, academics, research, and service. All awardees are invited to participate in the Awards Day Ceremony and Banquet held each April and are honored as a guest of the Department. In addition, some awards carry with them eligibility for honors at the College and University levels. A list of all awardees for the various awards presented since 1999 is provided in Appendix B.

Charles H. Butler Excellence in Teaching Award

Presented annually to a graduate teaching assistant(s) in recognition of excellence in teaching over an extended period. Professor Butler, a former Chair of the Department, was a faculty member from 1937 to 1965.

Department Graduate Student Teaching Effectiveness Award

Presented to a graduate student in recognition of significant contributions to the teaching mission of the Department. Recipients of this award may be recommended for the All University Graduate Student Teaching Effectiveness Award.

Department Graduate Research Scholar Award

Presented annually to a doctoral student in recognition of scholarly productivity. Recipients of this award may be recommended for the All University Graduate Research Scholar Award.

Department Graduate Service Award

Presented annually to a graduate student in recognition of extraordinary dedication and outstanding service to the Department of Mathematics.

Robert C. Seber Memorial Award

Awarded annually to advanced students in the Masters of Arts in Mathematics Education Program for outstanding scholarship. Professor Seber joined the Department in 1956 and served as Professor of Mathematics Education for 22 years.

Yousef Alavi Doctoral Student Award

Presented to an outstanding doctoral student in mathematics or statistics in recognition of excellence in the student's field of study, covering graduate studies, doctoral examinations, and research activities including the doctoral dissertation. Professor Alavi, a faculty member from 1958 - 1997, chaired the Department from 1989 -1992. Devoted to all aspects of the graduate program, he served for many years as the Chair of the Graduate Committee and as the Graduate Programs Coordinator, helping develop various Master's Masters and Doctoral Programs.

V. SEMINARS AND COLLOQUIA

Purpose

Seminars and colloquia in the Mathematics Department allow undergraduate and graduate students, as well as the general public, excellent opportunities to hear and *often interact* with prominent mathematicians, mathematics educators, and others who use mathematics in their fields of expertise. Such opportunities provide a chance for graduate students to begin to become part of the mathematics or mathematics education community, to gather ideas about possible research or dissertation directions, and to introduce themselves to future colleagues. It is expected that graduate students in particular make a regular habit of attending seminars and colloquia to enhance their graduate experience in the Department (see Talk Attendance Requirement section for details.)

Seminars

Each student is strongly encouraged to enroll in at least one seminar each academic year.

Seminars are offered regularly in Applied Mathematics, Graph Theory, Algebra, Topology, Analysis, and Math Education. The subject matter usually varies from term to term, depending on the interest of the participants. Seminars normally meet once a week and consist of informal lectures and discussions.

Some seminars cover research topics in specialized areas and are within the reach of only a few students. However, others are more accessible and provide an opportunity to discuss ideas not normally covered in classes, or to explore standard concepts more fully.

Seminars are usually initiated by faculty members, but a group of students interested in a particular topic may ask a professor to direct an appropriate seminar.

The Department Colloquium

In addition to the seminars offered, the Department maintains an active colloquium program throughout the year whereby scholars are invited to visit the Department and present a lecture. Occasionally faculty members in the Department present lectures as well. The topics vary widely over many areas of mathematics and mathematics education. Some lectures involve recent research in specialized areas, while others are more general and expository in nature. Usually the lectures are held in the Alavi Commons Room (6^{th} floor of Everett Tower) on Thursdays at 4 p.m. and are preceded by an informal gathering with refreshments. These colloquia provide an opportunity for all faculty and graduate students to extend their understanding into unfamiliar areas. They also provide an opportunity for faculty and graduate students to become better acquainted.

Graduate students are expected to attend colloquium lectures frequently, to meet the speaker, and interact with faculty and fellow graduate students. A good colloquium talk should be accessible to graduate students, at least for the first 15 minutes or so. However, not all speakers attend to such a format. Consequently, students may not be able to follow many of the details of the talk (many of the faculty will admit to the same problem), but don't be discouraged. It is still possible to pick

up general ideas and viewpoints from the lectures, and the stimulation and interest that can be generated by an inspiring lecturer is invaluable.

Math Club Talks and Math Honors Society

In addition to the opportunities seminars and colloquia provide to hear and interact with speakers, the Math Club organizes a variety of events, such as a weekly brown bag lunch, mathematical talks aimed at students, and social gatherings. Although one or two talks are given by faculty at Math Club events each semester, students are encouraged to give talks accessible to undergraduate and graduate mathematics students with the schedule typically devoted to these speakers. Events are free and open to all. A schedule can be found at http://www.wmich.edu/mathclub/calendar.html. Induction ceremonies into Pi Mu Epsilon (PME) each fall and spring semester also include a guest faculty.

Graduate Student Talk

The Graduate Student Representative(s) will organize graduate talks aimed to encourage conversations among graduate students. These talks will be used to discuss graduate students' experiences with teaching, research, prelims, dissertation, or anything that will be helpful, and create a sense of community for the graduate students. These talks will happen a few times a semester by announcement.

The TA Seminar

During the Fall and Spring semesters, faculty in the Department organize a TA Seminar. This seminar meets about every two weeks (six or seven times a term) and focuses on a variety of topics related to the teaching and learning of mathematics; examples of topics include technology use to promote learning, lecture styles, assessment, and tutoring techniques. TAs may request that certain topics they are interested in be addressed. Teaching assistants in their first two years of their teaching appointment at Western are required to attend and actively participate in the TA seminar; more experienced TAs are strongly encouraged to attend. Research Assistants who are supported through external funding are exempt from this requirement *until* they begin to receive support through a Department Teaching Assistantship. (Students should be aware that this could happen at any point within a student's program and they should work closely with their research advisor to prepare for such funding changes.)

VI. TALK ATTENDANCE REQUIREMENT

Each semester, the Department of Mathematics offers a number of talks in its Colloquium Series, Math Club and Pi Mu Epsilon meetings and Graduate Student Talk Series. It is important for all Department graduate students to avail themselves of these opportunities on a regular basis for the purpose of educational enrichment, professional growth, and becoming part of the larger community of mathematicians and mathematics educators. This requirement will be assessed as part of the annual review of graduate students. To this end:

- A full-time doctoral student is expected to attend at least 5 Department talks in each of the fall and spring semesters. At least 2 of these 5 should be Colloquium talks.
- A full-time masters student is expected to attend at least 3 Department talks in each of the fall and spring semesters. At least 1 of these 3 should be a Colloquium talk.
- A part-time graduate student is encouraged to attend a commensurate number of talks.

Students are responsible for providing evidence of meeting the minimums to submit as part of their annual review. This evidence can take on any number of forms; here are two examples: (1) keeping a list that includes the date, title/speaker and the signature of a faculty member who was also there; (2) photos posing with the speaker labeled with the date.

VII. PERMANENT PROGRAM OF STUDY AND ANNUAL REVIEW OF GRADUATE STUDENTS

Program Planning

Students must meet with their academic advisor to plan their program. Although the advisor is the expert on what is required for the completion of the chosen degree, most of the information is readily available in the online Graduate Catalog (https://wmich.edu/registrar/catalogs). Students will be able to make better decisions and avoid mistakes if they know as much as possible about the rules, requirements, and policies associated with the degree they seek. An important thing to know is that there are two main sets of rules to pay attention to: Departmental degree policy and University policy.

To view the Department requirements, students can go to the Graduate Catalog, and find their particular degree program under "Departments and Programs."

To view University policy, look at the section "Academic Policies," in the Graduate Catalog, in particular the subsection "Graduation Requirements" which includes information such as the number and level (5000+ or 6000+) of credits required in a degree program, as well as information about required grades. For example, for graduate study, **no course with a grade below "C" will be counted towards the degree** (however, it will count towards your grade point average).

One valuable resource for program planning is the "Six-Year Plan," which is a tentative schedule of all courses numbered 4000 and above. It can be found on the Department Web Page under "Academics"and then "Graduate Student Forms" as well as under "Advising." Many of the required course sequences are offered only every other year, so it is important for students to consult this plan with their advisor from the start and revisit it often as scheduled offerings may change.

Students in the mathematics Ph.D. program will work with their advisor so that their planned program will allow them to finish all three comprehensive exams no later than the end of their third year.

Program of Study

Early in the program each student must work with their advisor to **complete and submit a Permanent Program of Study to the Department Graduate Programs Assistant**. Forms are available online (https://wmich.edu/math/academics/forms-graduate) or from the Graduate Programs Assistant. Students in one of the master's programs must file this form **by the end of the second semester**; doctoral students **by the end of the fourth semester** of their program. If changes to the Program of Study are necessary at a later point in time, the document may be updated and resubmitted. The Graduate Programs Assistant submits these forms to the Registrar and, after a student applies for graduation, the graduation auditor will use this document to check whether all requirements for the degree have been met.

Annual Review of Graduate Students

In order to assist students in the timely completion of their Program of Study, and to advise them of their progress, the Department Graduate Committee conducts an annual review of all graduate students (in both the master's programs and programs leading to a doctoral degree) at the start of the spring semester. In particular, the Graduate Committee will look at whether students are maintaining the required GPA, and whether they are making timely and satisfactory progress in all aspects of their program. For all students this involves progress in coursework and relevant professional development activities. For students in any program leading to a doctoral degree, this also includes completion of the comprehensive exams by the required point in the program, directed teaching, the proposal defense, research tools, and dissertation research.

The student completes their annual review form and sends a copy to their advisor before meeting to discuss their progress. **It is the student's responsibility to schedule an appointment with their advisor.** The advisor then fills out their part of the annual review to complete the process **by February 1**. The annual report includes screen shot of grades for the past calendar year, a pdf of student evaluations (for TAs), and an up-to-date Program of Study (available from the Department web page https://wmich.edu/math/academics/forms-graduate or the Graduate Programs Assistant).

The Graduate Committee will then use the information to make a recommendation regarding a student's progress. Students and their advisors will be informed of the outcome **by March 15**.

There are three possible outcomes of the review that the Committee may recommend regarding a student's enrollment:

1. Continuation
2. Continuation with Reservations
3. Dismissal

If the recommendation is "continuation with reservations," the student must meet with their advisor to discuss strategies to address the reservations, and compose a written or electronic response to the Graduate Committee. This response must be submitted to the Chair of the Graduate Committee by March 31. The Committee's report, along with the student's response, will be added to the student's file. At the next annual review, the student must show adequate progress toward addressing the documented deficiencies, or face dismissal from the program.

Unsatisfactory progress resulting in program dismissal at the graduate level means that a person is not eligible to continue as a student at the University unless they apply to and are accepted into another program.

If a student disagrees with the outcome of the review, they may submit an appeal within one week of receiving the notification. This appeal must be submitted to the Chair of the Graduate Committee, either in writing or electronically. The Graduate Committee will then meet to consider the appeal and, as a result, will make a decision to either change the outcome or uphold the original decision. The student will be informed of this decision within two weeks of the appeal, and the decision is final except for those that recommend program dismissal. In cases where the decision

by the Graduate Committee after the appeal is still for program dismissal, a student has the right to appeal that decision beyond the Mathematics Department per the policy provided in the University Graduate Catalog under "Course Grade and Program Dismissal Appeals."

Please be aware that the Committee may also use these reviews to help with decisions on the awarding or continuation of graduate assistantships and scholarships.

Definition of Good Standing

A graduate student in the Department of Mathematics is deemed to be *in good standing* when the following conditions are met: (1) the student's degree program GPA is at least 3.0 (after the first semester or term in the program); and (2) the student is making timely progress towards degree as determined by the Department annual review of graduate students and by program requirements.

VIII. REGISTERING FOR CLASSES

Course offerings can be viewed through the Search Course Offerings option in GoWMU or directly at https://wmich.edu/classlookup/. (See **Program Planning** for more information about choosing which classes to take.) Mathematics Department graduate students register for their courses through their advisors. Once you and your advisor have agreed on which courses to take, your advisor will complete and submit the online Mathematics Department *Graduate Course Advisor Approval* Google form.

If you are registering for an independent study or readings course using a Math 5990 or Math 6990 number you will need to work with the instructor (your advisor or another faculty member who has agreed to be the instructor for the course) to identify a title (≤28 characters) and a description. The description is the agreement between you and the instructor about what you will need to do to successfully complete the course.

IX. THE PH.D. COMPREHENSIVE EXAMINATIONS

Purpose

The purpose of the Ph.D. Comprehensive Examinations is to evaluate the student's ability and understanding in three core content areas distinctive to each program, and to help determine whether the student is ready to proceed to the dissertation research stage. (Note: the comprehensive examinations are also typically called "qualifying exams," or known within the WMU Mathematics Department as "prelims.")

Because of the different content focus of the two doctoral programs within the Department, each program follows its own format for administering its comprehensive examinations. Doctoral students are expected to be familiar with and follow the rules for completing the comprehensive exams specified within their respective program.

Policies and Procedures for Comprehensive Exams

Students must take a comprehensive examination in each of three designated areas, as specified below, and will receive a grade of pass, marginal pass, or fail in each. The exam requirement is successfully completed when the student has received a grade of pass or marginal pass in each area, with at most one grade of marginal pass, and a grade of pass in the student's designated major area.

Mathematics Education

Students in Mathematics Education must take comprehensive examinations in each of the three competency areas for this program: 1) K-12 curriculum and instruction, 2) psychological foundations of learning mathematics, and 3) mathematics education research. The examinations in K-12 curriculum and instruction, and in the psychological foundations of learning mathematics

typically will be a three-hour written examination. (Some accommodations may be made for graduate students who are English Language Learners.) The examination in research and design will be a take-home examination written over a period of one week. When deemed necessary, this take-home exam will be followed by a one-hour oral defense conducted within two weeks of submitting the take-home and conducted by at least two graduate faculty in mathematics education.

Mathematics

Students majoring in Algebra, Analysis, or Topology must complete the two-semester graduate sequence of coursework and take a comprehensive examination in each of these three areas. Students planning to write a dissertation in an area of mathematics other than one of these three may substitute one of the course sequences and corresponding exam with coursework and an exam in the student's specialty. Procedures for substitution are described below.

Students are expected to register for any courses or course sequences required for a comprehensive exam the **first time** they are offered subsequent to the student's admission to the doctoral program. A student must take each comprehensive examination the **first time** it is offered following their completion of the required coursework in that field (or, in the case of retakes, the first time it is offered by the Content Area Committee which writes the exam). In order to delay an examination a student must appeal to the Graduate Committee.

If a student fails an exam, or receives a marginal pass, the student will be given one (and only one) opportunity to retake the exam. The grade of any second attempt will be the grade of record for that exam. A second failure in any area, or two marginal passes in any two areas results in dismissal from the doctoral program. Appeals regarding exam results may be made to the Graduate Committee within six weeks of notification of exam results.

A student must successfully complete the exam requirement within the first 3.5 years in the program. Exceptions to this timeline must be approved by the Graduate Committee.

Substituting Coursework and Comprehensive Exam

A student in the Mathematics Ph.D. program may, with the approval of their advisor and the Graduate Committee, substitute a required graduate sequence and corresponding comprehensive exam in one of the specified areas with coursework and a comprehensive exam in the student's planned area of specialty. Only one substitution is permitted. For example, an approved plan of study might specify that the graduate sequence in Graph Theory will substitute for the sequence in Analysis, and that a comprehensive exam in Graph Theory will substitute for the exam in Analysis. The student would then take coursework and exams in Graph Theory, Algebra, and Topology, and would not be permitted any further substitution, such as replacing Topology with Analysis. Substitution proposals must be submitted by the advisor to the Graduate Committee at least three months prior to the plan proceeding. The proposal must include a clear description of and rationale for the submission, a timeline for completion, and a list of faculty (minimum of two) who have agreed to be responsible for any courses or exam (construction and grading) under consideration. Exceptions to this policy must be approved by the Graduate Committee.

Writing and Proctoring Exams

The appropriate Content Area Committee writes and proctors the examination in that content area, and decides on the date and time for administration of the exam. The amount of time allowed for an exam is at least three hours and is set by the Content Area Committee. The examinations will be at a level of difficulty and of such length that a well-prepared student can successfully complete the exam in the time set by the Content Area Committee. The student is advised to talk to a member of the appropriate Content Area Committee to find out about the committee's policies and the existence of a syllabus or samples for the exam.

Evaluation of the Exam

The evaluation of the exam performance in each area will be done by the appropriate Content Area Committee that composed the exam (typically comprised of 3-6 faculty members). The overall evaluation on each exam will be Pass or Fail. At the discretion of the examination committee, a grade of Marginal Pass may also be assigned to a borderline performance. The student will be informed of the outcome in a written letter from the Content Area Committee and the Graduate Programs Assistant (usually within two weeks of administration of the exam). Copies of the evaluation letter will be sent to the student and to the student's advisor. The exams will not be returned to the student, but each student is encouraged to see and discuss their results with a member of the Content Area Committee.

Policy on Non-Program Students

A student not enrolled in one of the Ph.D. programs may, with approval of the Graduate Committee, take any Comprehensive Exam they desires. However, it is emphasized that the limit of two failures in any one area or two marginal passes in any two areas applies without regard to acceptance into a Ph.D. Program. Thus, for example, if a student fails the Algebra Comprehensive Exam before being accepted into the program, and fails again after acceptance into the program, they will be dismissed. Appeals may be made to the Graduate Committee.

X. GUIDELINES FOR THE DIRECTED TEACHING REQUIREMENT FOR DOCTORAL STUDENTS

Acquiring experiences in teaching is an important part of the preparation of doctoral students. A required component of each doctoral program within the Department of Mathematics is *directed teaching,* in which typically the candidate becomes the instructor of record for an undergraduate mathematics course, mathematics education course, or some other approved alternative. The purpose of this requirement is to give the graduate student a structured experience of teaching a course within a university environment, where many graduates will ultimately become employed after graduation. Because this requirement involves both programmatic and overall Department considerations in terms of scheduling and staffing of courses, the following guidelines are intended to help facilitate this program component.

The decision of how and when to fulfill this requirement is done on a case-by-case basis, and should be a topic of discussion during the annual review when advisors meet with their advisees to examine progress through the graduate student's program (see possible options of directed teaching experiences at the end of this section).

To allow for adequate preparation for and scheduling of the directed teaching experience, the Associate Chairs of the Department must be informed at least 12 months in advance of the intended semester for directed teaching. The two Associate Chairs, the Graduate Committee, and a student's main program advisor will use program progress information to alert the student and relevant faculty when this program component is approaching.

Well before the directed teaching semester, substantive conversations should focus on the specifics of the experience, that consider various possibilities, such as a preliminary semester of shadowing the course to be taught, one-on-one mentoring, a two-semester alternative directed teaching experience, etc. Such conversations may need to include other relevant personnel such as the Associate Chairs and other experienced faculty who the graduate student could work with in the directed teaching experience.

When the doctoral student is ready to undertake directed teaching, the advisor, in consultation with the relevant Associate Chair, will assign an appropriate course for the doctoral student to teach as the instructor of record. A faculty member, who is ideally not the student's research advisor, will be assigned to be the **mentor** for the directed teaching experience. The student/mentor team is to be formed a minimum of 9 months prior to the semester/session in which the course is to run so that adequate lead-time is available for both scheduling concerns and proper planning. In the Mathematics Education Doctoral Program a semester of "shadow" teaching is required prior to the semester of directed teaching.

For those students who complete the typical directed teaching experience as the instructor of record, the student and mentor are to discuss the plan of activities involved with the course well before the first class meeting. This will include decisions regarding the formal first-day handouts and a completed syllabus that lists the policies under which the course is to be run, such as: the course objectives, grading policy, incomplete grade policy, make-up exam policy, office hours,

course outline and assignments. A final discussion of these completed documents should be conducted during the week prior to the start of the class. For other course components, the student should discuss well in advance with the mentor issues regarding tests to be given, grading of tests, and how to give useful feedback to the students. It is expected that the student-mentor team will have conversations about course assessments and their effectiveness at regularly scheduled times during the semester of directed teaching. The final grades in the course will be assigned by the graduate student (as the instructor of record) in consultation with the mentor.

The mentor must periodically visit the classroom to supervise and assess the activities. A minimum of three visits during the semester/session is recommended; each visit is to be followed by a consultation between the student and the mentor regarding the observation.

The graduate student must inform students in the course they are teaching about the availability of the university-approved online student evaluation forms. All students should be encouraged to complete the course evaluations to provide feedback regarding the course and its instruction.

After posting the final grades, the student and the mentor should meet at least one more time for a final evaluation to review the work done in the course, consider the report on the analysis of student evaluations, and to reflect on strengths and areas of improvement related to their teaching skills. After this meeting, the mentor is to submit to the Chair of the Instruction Committee a brief note indicating the performance of the student in their directed teaching experience.

Mentors should encourage participation of the doctoral students in faculty discussions on collegiate mathematics teaching and curricula, and bring to the graduate students' attention suitable opportunities and activities of this nature. The mentor should also recommend appropriate seminars and/or teaching workshops.

XI. THE PROCEDURES LEADING TO THE COMPLETION OF A DOCTORAL DISSERTATION IN THE DEPARTMENT OF MATHEMATICS

The purpose of the dissertation is to evaluate the student's ability to conduct original research based on the knowledge gained through coursework, other experiences, and interactions with faculty.

The procedures for the Ph.D. in Mathematics and those for the Ph.D. in Mathematics Education are somewhat different, thus they are described separately. Relevant forms can be found at https://wmich.edu/grad/forms.

The Procedures for the Ph.D. in Mathematics

1. Shortly after a student successfully completes most (or, ideally, all) basic course requirements and all three Comprehensive Examinations, the student seeks out a dissertation advisor among the graduate faculty in mathematics. According to the Department Policy Statement, "To serve as a dissertation advisor, a faculty member must have current membership in the Graduate Faculty and be currently active in the area of the proposed dissertation. The Department Chair, in consultation with the Associate Chair for Instruction and the Executive Committee, makes assignments as dissertation advisors." Once the faculty member agrees to act as the student's dissertation advisor and has been so appointed, the student discusses possible directions for research with this advisor, does background reading on the subject, and, with the aid of the advisor, develops questions for possible study.

2. Once possible research questions have been chosen, and some preliminary results have been obtained, a dissertation committee of at least four members is formed. The dissertation committee will consist of the dissertation advisor who will be the committee chair, a second reader, at least one more faculty member, and an outside reader, i.e., a faculty member from outside the Department, and often from outside the University. The dissertation committee is proposed by the student's advisor in consultation with the Department Chair, and must consist of graduate faculty only and be approved by the Department Chair, the Dean of the College of Arts and Sciences, and the Dean of the Graduate College. If the outside reader is not part of our graduate faculty, they must be separately approved. For this purpose, a current curriculum vita for the proposed outside reader must be submitted to the Graduate Programs Assistant.

3. After the dissertation committee has been approved, and the student has a complete proposal for his or her dissertation project, the student and the committee will jointly determine a date and time for the proposal defense when a majority of the committee members can be present physically or virtually. For the proposal defense, the student gives a public presentation of the proposed research and answers questions about the proposal. After the presentation, the dissertation committee will meet with the student to discuss the proposal further, and to make a final decision on acceptance of the proposal. The proposal defense should be scheduled at least one year before the final dissertation defense and graduation. On approval, a Doctoral Dissertation Proposal Approval form must be completed, along with a Doctoral Candidacy form.

4. When enough results have been obtained that the dissertation is almost complete, and the student has completed all other requirements for the Ph.D., the student and the dissertation committee will jointly determine a date and time for the dissertation defense. A defense cannot be held unless three committee members (including the advisor) are present, either physically or virtually. If a committee member is not present at the defense, then this member must have submitted a positive report to the chair of the committee at the time of the defense.

5. The student shall prepare an abstract and complete the form required to schedule the oral defense, submitting these to The Graduate College at least two weeks prior to the defense.

6. The Chair and Second Reader of the dissertation committee certify in writing to the Chair of the Graduate Committee, at least five working days prior to the defense, that the work constitutes acceptable research for a Ph.D. dissertation. A defense will not be scheduled unless all program requirements have been satisfied. This certification is necessary, but not sufficient, for a successful defense.

7. For the defense, the candidate will give a public lecture on the dissertation. Following this presentation, a period of time will be allowed for questions to the candidate from those in attendance. After a brief break, the candidate will be examined on the dissertation and related topics by the committee and any other faculty members. At the conclusion of this examination, the candidate will be excused while the committee determines the acceptability of the dissertation and defense. Unanimous approval of the committee is required for both the dissertation and the defense. The virtual presence of a committee member is acceptable at the defense, particularly in the case of an outside reader.

8. The student is then responsible for completing any alterations recommended by the committee, the timeline for completing them, and the subsequent forms needed by the university and the Graduate College. Following the approval of the dissertation by the committee, two copies of the dissertation are submitted, together with the forms signed by the Committee, to The Graduate College for final approval. The student is responsible for completing these tasks by the deadlines established each semester by The Graduate College. The dissertation advisor will supervise these final steps of the process.

The Procedures for the Ph.D. in Mathematics Education

1. Upon admission a student will, within the first year of enrollment, work with a two-member advisory team to design a Plan of Study for completing the Ph.D. At this time, any course requirements already satisfied through prior master's level work will be determined by the advisory team and approved by the Graduate Committee. After a tentative Plan of Study has been designed, one of the advisory committee members will be assigned to serve as the student's primary advisor for program matters leading up to the formulation of a dissertation proposal. The Plan of Study may be reviewed and adjusted as necessary throughout the program.

2. A student will schedule comprehensive examinations in consultation with the program advisor. (See *The Ph.D. Comprehensive Examination* section for more information.)

3. By the time a student has passed comprehensive examinations in both curriculum and instruction and in psychological foundations, the student will take reading courses from a potential dissertation advisor with the goal of developing a proposal for dissertation research. Depending upon the nature of the proposed research, the student may be required to conduct a pilot study.

4. As soon as a student has passed all three comprehensive exams and shown competency in the three required research tools, the student will, in consultation with a chosen dissertation advisor, form a dissertation committee. The chosen dissertation advisor will become the student's program advisor. The dissertation committee shall consist of the dissertation advisor, a second reader, at least one other faculty member, and an outside reader (that is a member from outside the Department or the University). When the student has a complete proposal for their dissertation project, the student and the dissertation committee will jointly determine a date and time for the proposal defense such that a majority of the committee members are present physically or virtually. During the proposal defense, the student will give a public presentation of the proposed dissertation research and answer questions on the proposal. After the presentation, the dissertation committee will meet with the student to discuss the proposal further and make a final decision on the acceptance of the proposal. A student will be allowed to take MATH 7300 credits only after a dissertation committee has been formed and the dissertation proposal is accepted by all of its members.

5. After completing a dissertation and all other requirements for the Ph.D., the student and the dissertation committee will jointly determine a date and time for the dissertation defense such that a majority of the committee members are present physically or virtually.

6. The student shall prepare an abstract and complete the form required to schedule the oral defense, submitting these to The Graduate College at least two weeks prior to the defense.

7. During the dissertation defense, the student will give a public presentation of the dissertation followed by a question period open to the public. After this presentation, the dissertation committee will meet with the student to discuss the dissertation further. The dissertation committee will then meet in private to make a final decision on the acceptance of the dissertation and defense. Finally, the committee will meet with the student to share the outcome of the dissertation defense. *All* committee members must agree on acceptance for the dissertation to be complete.

8. The student is then responsible for completing any alterations recommended by the committee, the timeline for completing them, and the subsequent forms needed by the university and the Graduate College. Following the approval of the dissertation by the committee, two copies of the dissertation are submitted, together with the forms signed by the Committee, to The Graduate College, for final approval. The student is responsible for completing these tasks by the deadlines established each semester by The Graduate College. The dissertation advisor will supervise these final steps of the process.

“Stopping the Clock” for Graduate Degree Programs

A student who encounters issues that will affect his or her ability to successfully complete continuous work in their Program of Study may request a leave of absence for up to two semesters and two sessions. Reasons for leave of absence include bereavement, illness, care giving, maternity, paternity, and call to active duty. Such a leave of absence “stops the clock” associated with the respective program for the requested amount of time. If such a situation occurs, the student needs to inform the Graduate Committee and contact the Graduate College in order to process the required forms needed to complete the process.

XII. RESEARCH TOOLS REQUIREMENT FOR THE PH.D. DEGREE IN THE DEPARTMENT OF MATHEMATICS

Ph.D. in Mathematics

Candidates for a **Ph.D. in Mathematics** must demonstrate proficiency in categories 1-3 and either category 4 or 5. For each tool, the candidate must secure a faculty mentor who both approves the selection of the tool in the category (language or software) and checks the desired proficiency. MATH 6880, Research Tools in the Mathematical Sciences, may be offered (usually for one credit) to provide a more structured way to achieve some of these proficiencies, but this course is not required.

1. ***Mathematical typesetting**
   - The appropriate tool is a modern implementation of TeX (LaTeX, LuaTeX, pdfTeX, or XeTeX). Any other software must be approved by the Graduate Committee.
   - Proficiency is demonstrated by providing samples of typed work and by completing a sequence of assigned tasks.

2. ***Presentation**
   - Research an approved topic.
   - Present the topic to a general audience using computer presentation software (generally the TeX package beamer, but possibly PowerPoint). Students should demonstrate a reasonable proficiency with the use of a variety of presentation features such as overlays, animations, embedding graphics, etc.

3. ***Mathematical literature search tools**

   Demonstrate appropriate skill in searching the mathematical literature with MathSciNet, Google Scholar, or other appropriate software.

4. **Foreign language**
   - Approved foreign languages are French, German, and Russian. Any other language must be approved by the Graduate Committee.
   - Students are required to demonstrate an ability to understand a mathematical paper or a section in a mathematical book in that language. Faculty choose the piece to be translated of reasonable length (typically 4-8 pages); students are permitted to use translation tools.

5. **Mathematical research software**
   - Appropriate systems are normally computer algebra systems or numerical analysis computation packages, but a research computer programming language with libraries might also be approved. (Current examples are GAP, Magma, Maple, Matlab, Mathematica, Sage, Scilab, Python, and Julia. Statistical and financial computational

tools such as R and SAS, may also be appropriate.)
- Proficiency is required in one such system.

Ph.D. in Mathematics Education

Candidates for a Ph.D. in Mathematics Education must demonstrate proficiency in the following areas prior to beginning their dissertation. For each tool, the candidate must secure the signature of a faculty mentor who both approves the selection of the tool in the category and verifies the desired proficiency.

- **Computer tools for quantitative research**
  - Appropriate tools are comprehensive quantitative data analysis programs such as SAS or SPSS
  - Proficiency is required in one such program
  - Proficiency can be demonstrated by the following means:
    - Completing a course that has use of SAS or SPSS as a key component
    - Completing a project that relied on a quantitative data analysis program

- **Computer tools for qualitative research**
  - Appropriate tools are comprehensive qualitative data analysis programs such as Nvivo, HyperResearch, NUD•IST
  - Proficiency is required in one such program
  - Proficiency can be demonstrated by the following means:
    - Completing a course that has use of a comprehensive qualitative data analysis program as a key component
    - Completing a project that relied on a qualitative data analysis program

- **Computer tools for student learning**
  - Experience is required with one tool from each of the following categories:
    - Computer Algebra Software
    - Dynamic Geometry Software
    - Data Analysis Software
    - Handheld Technologies
  - Proficiency can be demonstrated by the following means:
    - Completing a course that makes use of these technologies
    - Completing a project(s) that incorporates these tools

XIII. GRADUATE STUDENT APPOINTMENTS

The following are brief descriptions of some funding options available to Department graduate students. Additional information on these and other funding opportunities can be found at the following website: wmich.edu/grad/fellowships-grants.

Graduate Teaching Assistantships

A limited number of graduate teaching assistantships are available from the Department of Mathematics. For new graduate teaching assistantships, the application forms, transcripts, and letters of recommendation should be submitted to the Department of Mathematics by February 15 for the subsequent academic year. Applications submitted after that date will be considered only if there are openings. A student holding an assistantship is required to perform 20 hours of service per week in the Department and enroll in at least six-credit hours per semester. The assistantship will pay the full tuition, not including enrollment and other fees.

University Fellowships

University Fellowships are available from the Graduate College for outstanding students beginning a Master's degree program. Application forms, transcripts, and letters of recommendation must be submitted to The Graduate College by 15 February. Students in mathematics and statistics applying for a University Fellowship are also encouraged to apply for one or more of the other appointments described below.

Graduate College Dissertation Completion Fellowships

A limited number of Dissertation Fellowships are available, in open competition and on the basis of superior scholarly achievement. Recipients are provided with service-free stipends for one year to assist them in completing their dissertation. There is no service obligation with a dissertation fellowship. To be eligible, an applicant must be a doctoral candidate who can demonstrate superior academic achievement, and have a record of timely and steady progress toward degree completion. Applicants must have completed all requirements for the degree except the dissertation, and must have an accepted dissertation proposal. Selection criteria will include a superior academic record (scholarly excellence is the most important criterion in selecting fellowship recipients), a dissertation proposal which holds the promise of contributing to the body of knowledge and literature in the discipline, and a realistic expectation that the dissertation will be completed within the time period of the fellowship.

General Requirements

The general requirements for graduate students who hold a graduate assistantship appointment from the Department of Mathematics are as follows:

a. Students must be admitted to one of the graduate programs in the Department of Mathematics or the Department of Statistics. Exceptions may occasionally be made, but

only with the approval of the Graduate Committee and the Chairperson of the Department of Mathematics.

b. Students must complete at least 6-credit hours of approved course work in their program each semester, and, if listed as a requirement in their appointment letter, three hours in the summer. Students need prior permission from the Graduate Committee to take more than 3 courses per semester.

c. **Students must maintain at least a 3.0 grade point average in all coursework. Failure to meet this criterion results in automatic academic probation until grades in subsequent coursework are sufficient to raise the GPA above this threshold. Two successive semesters on academic probation will result in revocation of the appointment.**

d. Students with a graduate appointment must perform satisfactorily in their assigned teaching or other responsibilities.

e. Students shall not engage in regular outside employment during the term of the appointment. Any temporary or occasional outside employment (either on campus or off campus) must be approved by the Chair of the Department.

Renewal

Graduate students who have received an appointment from the Department of Mathematics or have received a University Fellowship may normally expect to receive continued support to the conclusion of their program (see (c) below). A renewal appointment will normally be given to students who meet the following conditions:

a. The student remains in a graduate program in the Department of Mathematics. Students who switch programs inside the Department, will typically receive continued support, provided that the other conditions are met.

b. The student has satisfactorily fulfilled the General Requirements outlined above. For the purpose of requirement b above, an **Audit** or **Withdrawal** does not count toward the required 6 hours of credit per semester. An **Incomplete** will count only after it has been removed and replaced by a grade. Exceptions may only be made with the approval of the Graduate Committee and the Department Chairperson.

c. **Students will not normally be supported for more than a total of two years for Master's level programs, or for more than a total of five years for all programs leading to a Doctoral degree.**

One Semester Appointments

One-semester appointments may be made if appropriate. Normally a student with a one-semester appointment will be expected to fulfill all of the requirements specified for students with whole year appointments, for the semester of their appointment.

Summer I /Summer II Graduate Student Appointments

Graduate Assistants who have held an academic year appointment and have not yet completed their program may be offered a Summer I or Summer II session teaching appointment, based on availability of such positions. Priority will be given to Doctoral Associates. Considerations for these appointments are: academic progress at WMU, faculty recommendations, and whether the student has accepted an assistantship for the following year.

In all cases, satisfactory past teaching performance and adequate progress towards finishing the graduate program are both necessary requirements.

Final decisions about summer appointments will be made by the Chairperson of the Department, taking into account program needs, as well as student financial needs whenever necessary and appropriate.

XIV. INFORMATION FOR GRADUATE STUDENTS WHO HOLD AN ASSISTANTSHIP, ASSOCIATESHIP, OR FELLOWSHIP

All rights and privileges granted to students holding a graduate assistantship or associateship are also granted to students possessing a fellowship. Some of these benefits are listed below.

Identification

All graduate students receive photo ID cards. These cards may be obtained in the Bernhard Center at the Student ID Office. Once the card has been registered with the Office Coordinator, the card may be used for after-hour access to their office building.

Housing

Graduate Assistant housing is available in residence halls or married student apartments. More information is available from the Housing Office (https://wmich.edu/housing/options; Spindler Hall phone 269-387-7101; Married Housing phone 269-387-2175).

Library

Graduate Assistants have the same privileges and responsibilities as faculty members in the use of the library facilities. In addition, the Graduate Student Commons is a space just for graduate students to study. It has group study rooms, comfortable seating, and private individual study cubicles. The Graduate Student Commons is located on the third floor of Waldo Library and requires a student ID for entrance. Graduate students also have access to the Virtual Reality Lab, the Makerspace, and the Learning Glass Studio. Further information is available on the Library's website (https://wmich.edu/library).

Parking

The university provides free Graduate Assistant parking permits that may be obtained at the Parking Services office with an offer letter and a photo ID. Married housing parking is not considered campus parking.

Graduate Assistant Offices

Offices for graduate assistants are on the 1st, 3rd, 4th, 5th, and 6th floors of Everett Tower and several offices in Rood Hall. Mailboxes for Mathematics Department Graduate Assistants are located in **Room 3319, Everett Tower,** the main Departmental office.

According to Department policy, when a graduate assistant is meeting with a student in their office, the office door should be wide open. Furthermore, graduate students must avoid any behavior that might be construed as unprofessional or harassing. Smoking and vaping is prohibited in all offices (including GA offices), classrooms, and buildings on the entire WMU campus.

Keys

Keys to graduate offices will be distributed at orientation or may be obtained from the Graduate Programs Assistant. Graduate assistants also will be issued a PASSKEY that will open the classrooms, the kitchen on the 6th floor, and conference and seminar rooms.

Teaching Assistants Union

The Teaching Assistants Union (TAU) is a labor union that represents teaching assistants at Western Michigan University. They are a local of the American Federation of Teachers both in Michigan and nationally – their local number is AFT #1729. Membership in TAU is voluntary and requires a small fee that is automatically deducted from the paychecks of those who choose to become a member.

Paycheck Distribution

Graduate Assistants are paid every two weeks and can choose to receive their pay on a pay card, issued by Payroll Services, or by direct-deposit into their bank account. No paper checks are printed. Problems or questions concerning payroll should be referred to the Graduate Programs Assistant, currently Ms. Elizabeth Roe, or the Administrative Assistant to the Chair, currently Ms. Sue Simons.

Course Coordination

Textbooks and course outlines for the courses graduate students teach can be obtained from the Course Coordinator. It is very important that TAs follow course outlines in consultation with their supervising professor. TAs must attend all course meetings for the courses that they are teaching; part of the evaluation for contract renewal is dependent on attendance at and participation in these meetings.

Tuition and Fees

Graduate Assistants receive tuition remission as part of the offer of appointment. For master's degree students, this pays for up to eight credit hours per semester and three credit hours per summer session during each term of appointment. Doctoral students receive tuition remission for up to nine credit hours per semester, plus three credit hours per summer session. Graduate assistants are responsible for all fees incurred during each semester or summer session.

The Teaching Assistants Union (TAU) negotiated the option for their members who are on appointments and do not use the full amount of their allotted credits of tuition remission during either of Fall/Spring semesters may defer the unused credits to the Summer I and/or Summer II session subsequent to the Fall/Spring semester in which the credits were granted. The following language is from the 2018-2022 contract; check the Academic Labor Relations website for updates (https://wmich.edu/academic-labor-relations/agreements/agreements-tau)

To qualify for delayed use of tuition remission credits, the graduate assistant must meet the following conditions:

1) Hold an active appointment during the Spring semester immediately prior to summer session/s for which delayed tuition remission is being sought.
2) Be registered for the classes in the Summer I and/or Summer II term for which use of the delayed remission is sought, and
3) Have submitted notification to the Graduate College at least 30 calendar days prior to the start of the session in which the Employee wishes to apply for use of delayed tuition remission (by use of the Graduate College-approved form of his/her intent to utilize delayed tuition remission credits.

XV. SUGGESTIONS FOR TEACHING ASSISTANTS

Each teaching assistant will be assigned a teaching supervisor, as well as a teaching mentor, for each semester and session that is taught. In some cases, the supervisor and the mentor will be the same person. If you are teaching a discussion section, the teaching supervisor will be the instructor for the large lecture. If you are teaching a lecture course, then the supervisor will typically be the course coordinator for this course. For courses in the Developmental Mathematics Program (Math 1090, Math 1100, and Math 1110), the supervisor is one of the directors of the program, Dr. Kirsty Eisenhart or Ms. Thayma Lutz. You should consult your supervisor regarding the manner in which the class is to be conducted along with questions about homework, exams, grading and other issues related to the day-to-day operation of the course.

Good teaching is more than accidental; it requires effort. Being a good and effective teacher requires careful planning and a continuous evaluation of the techniques used, as well as the results obtained. It should be an exciting and challenging experience for both the teacher and the student. Effective teaching must be every teacher's goal. It is the purpose of this section to offer some procedural suggestions and provide guidelines to help you work towards achieving this goal. The TA Seminar will build upon these ideas and provide time for you to discuss topics with the faculty leading the seminar along with your peers.

First Day of Class

Your first class period should be designed so that students see that the course will be interesting and that the material to be studied is worthwhile. You are required to hand out a syllabus with pertinent information (such as that listed below) or to refer students to the appropriate online location for this information. Check with your supervisor or course coordinator concerning the details of the information.

1. Name, number and section of the course.
2. Days, hour and meeting room of the course.
3. Textbook and author(s), and how much of the textbook material is to be covered.
4. Your name, office location, email and phone (optional), and the Main Department Office phone (387-4510). Establish office hours as soon as possible and be sure to include "other hours by appointment." Some of these office hours may be in the tutor lab.
5. Class policy for establishing grades, testing procedures, homework, make-up exams, late assignments, and attendance.
6. The syllabus must also contain a WMU statement pertaining to accommodations for students with disabilities and a variety of other issues. Those statements are sent annually to instructors with updated information from the Provost’s office.

Printing and Photocopying

The office staff will make photocopies of any material you may need for your class if you have it prepared and handed in **24 HOURS** in advance of the time you will need it. To have copies made,, attach a completed photocopying information form (available in the office) to your original(s) and put them in the photocopy request basket in the main Departmental office. The office staff will photocopy and collate the material (if requested) and place all copies in your mailbox.

In order to minimize waste, consider posting materials that students might simply refer to online, rather than handing out a copy to each student. Clearly quizzes and exams that students will need to write their work on and turn in will need to be copied. **You may not use printers to print classroom sets of materials, as doing so increases Department expenses.**

Student Attendance

Regular attendance plays an important role in student success. Many students are tempted to stop attending class, especially if the initial material looks familiar to them. It is critical that the work in class goes beyond what students would get from simply reading the textbook and doing the exercises within. Therefore, consider using tasks/problems that you create rather than only doing problems from the textbook, so that students are exposed to problems they would not likely see elsewhere. Other options include making attendance worth a small percentage of the final grade. Frequent quizzes can also encourage the students to come to class regularly, especially if some of the quizzes are unannounced. Giving quizzes (or taking attendance) at the beginning of class, rather than later, also encourages punctuality.

Homework

It is fundamental to the understanding of mathematics (especially at the beginning level) that students complete their homework. The importance of the assignment - the working of problems and exercises - cannot be overemphasized. Assignments should be given for each class session. Students should understand that they must spend time reviewing classroom notes and doing homework assignments and they must plan for this time in their schedules, in order for them to be successful in the course. Frequent work in mathematics assures that students will be prepared for the lectures, able to ask questions, and to participate in class discussions and tasks.

You should not collect homework unless you plan to do something with it. Grading selected problems, for example, can be very helpful to the student. For an unusually challenging problem, it may make sense to hand out a solution, but only after the students have had time to arrive at a solution of their own. Another possible approach is to have a few students share solutions to the assigned problems, so that different approaches may be discussed in whatever detail is required for understanding. Students can then consider whether all of the solutions are correct or not, consider whether the solution processes seem legitimate and logical, and identify similarities and differences among the solution processes. This will allow you to encourage students to develop problem-solving skills related to determining whether more than one correct answer is reasonable for any given problem, determining whether more than one strategy is reasonable, identifying common mathematical structures among strategies, and debating levels of efficiency. Sharing

student solutions can be done by having students copy their work on the board, or by having collected written solutions on the document camera. The later allows students' work to be anonymous (if names are hidden), and can make the analysis of common misconceptions or errors less personal.

Be sure to be clear about whether or not homework will be counted as a formal part of students' grades. If homework is not counted as part of students' grades, its importance can be stressed by frequent sharing and analysis of their work. Also, the rewards for doing homework should become adequately clear through assessments that build off of and extend that work.

Testing Procedures

It is important to provide students with frequent evaluation and feedback on their work. This encourages students to "keep up" rather than to try to "catch up" at the end of the semester - an extremely difficult task in mathematics. Frequent evaluation of achievement helps assure students that their efforts are satisfactory, or alerts them to the necessity for more effort on their part. Make sure to check with the course coordinator about the number and type of assessments that will be administered for your course.

Short quizzes (if you or the course coordinator decide to use them) should emphasize the material that immediately precedes them. A short quiz might cover a week's worth of material. An hour-long exam usually covers a longer time period and is more comprehensive. In any case, the student should be well informed as to the nature of the test or quiz and their importance as an assessment tool.

It is necessary to proctor your exams. This makes it possible for you to interpret exam questions, if necessary, and it will help to insure that each and every student will be doing their own work. Spread out the students in the room as much as possible. Careful proctoring requires that the instructor not remain in one place during the entire class session. [See section below on cheating.]

Your exam should be a learning experience for the students, as well as a means of evaluating their performance. However, while questions should require some original thinking, you need to remember that only a limited amount of this type of performance can be expected in one short hour. Exams should be carefully prepared as to length - neither too long nor too short. If you can write out complete solutions to the exam materials in about 1/4 to 1/3 of the allowed time, your exam is probably about the right length. A good exam helps provide information to the instructor about the capabilities of their students and their current understandings of the material. Vary the difficulty of the questions with perhaps the initial items accessible to all students. This may give the students some confidence and may help reduce any test anxiety. Encourage the students to start with those questions for which they feel they have sufficient understanding to present a satisfactory solution. Remember that success breeds success.

Require your students to be present at all exams. It is difficult to give fair make-up exams. In addition, it is extra work to write make-up exams. This is a problem that you will have to face, however. If you give several exams, then you might announce that there will be no make-up exams, but you will discard the lowest exam score in determining the final grade. In the case of a student

missing an exam, that would be the one that is automatically dropped. Another option is to ignore the missed exam, but double-count items on the final exam dealing with that material. You should check with your supervisor concerning this policy, and be sure to advise the students clearly of the rules.

All exams and quizzes should be typed and readable. The goals of the problems should also be clear. One way to check clarity of an exam or quiz you have created is to actually take it yourself. Each assessment that you give must be shown to your teaching supervisor before it is finalized.

Exams should be graded promptly so that scores may be discussed with your supervisor before returning them to the class. When correcting the exams, you should give reasonable partial credit. Perhaps the majority of the credit should be given if there is clear evidence that a student understands the concept being tested. A student should not be penalized severely for an arithmetic mistake (assuming the problem is not simply arithmetic). Point out any mistakes made by the student, with explanations if possible, rather than just writing down the number of points they have received or lost. Consider handing out solution sheets after the exams (and make-up exams) have been completed. In addition to finding out the correct solution and which mistakes they have made, the students will learn how a solution should be written up in a clear and logical way.

Grades

Unless a student is auditing your course, you will have to assign a grade to each of your students.

All inquiries for incomplete grades must be discussed with your teaching supervisor. Incomplete grades may be given to a student when illness, necessary absence, or other reasons beyond the student's control prevent completion of course requirements by the end of the semester or session. This grade may not be given as a substitute for a failing grade. When a student applies for an Incomplete Grade, the instructor completes an online form (accessible at gowmu).

Your grading policy should be clearly explained in the syllabus, and thus each of your students should have a fairly good idea of how they are doing from the scores you have given on the tests, quizzes, and possibly the homework. The assigning of final grades is an important and sometimes a difficult task. You will get to know some of your students and will want them to receive good grades. However, the grade you award a student needs to indicate how well the material has been mastered and whether the student should continue in the sequence. It is Department policy not to allow a student to continue to the next course in a sequence if a DC, D, or E has been assigned. This policy also applies whenever a given course is a prerequisite to further mathematics courses. After you have decided on final grades for your students, you should discuss these with your teaching supervisor prior to posting them online.

You should explain the grading system for the course to your students as early as possible so that they will know what they must achieve to receive a certain grade.

Disruptive Students and Cheating

You should do everything you can to set a tone of respect and collegiality in your classes by you first being respectful of your students. It is also helpful to take the time throughout the semester to have "tone setting" conversations with your students. These can be brief, but should highlight the positive behaviors students are exhibiting in class and how these have made a positive impact on their learning. For example, a student who might be struggling with a problem could raise their hand and say, "I am frustrated, because I know this answer is wrong but I don't know why." You could then let the student explain what they have done thus far and why they know their solution is incorrect and ask the rest of the class to discuss the solution to help resolve the student's issue. At the end of that discussion, you could briefly address tone setting and say, "I just want to thank so and so for being willing to share what was frustrating them even though they did not have a correct solution. I think the time we spent trying to resolve the issue really helped us to think more deeply about this problem and understand it better."

Without this kind of positive tone setting, occasionally you may have to deal with students who are behaving inappropriately. This may consist of disruptive or obnoxious behavior. The Student Code of Honor gives clear explanations of what constitutes disruptive behavior.

You do not need to tolerate inappropriate or disruptive behavior in your classroom or in your office. If the problem is minor, ask the student to talk to you after class and point out what about their behavior is not acceptable. If the inappropriate behavior rises to the level where you feel it has to be stopped immediately (for your safety or that of your students, or because you are unable to conduct your class properly), ask the student to leave the classroom. If the student does not comply, call the campus police (387-5555) to have the student removed. In each case, you should talk to your teaching supervisor after each incident occurs. Together, you should then decide whether to charge the student with a Student Code of Honor violation.

You may also have to deal occasionally with some form of academic dishonesty (cheating). The Faculty Senate suggests including a paragraph on academic dishonesty in the syllabus. If you assemble your own syllabus, you should follow that recommendation. Also, include as many of your policies as possible in this document, such as cell phone use, calculator use, laptop use, how much collaboration is acceptable for homework or projects, etc.

If you suspect a student or students of academic dishonesty, talk with your supervisor BEFORE saying anything to the student. There is a clearly outlined process to follow that includes filling out an academic dishonesty charge form and submitting it to the Office of Student Conduct, with as much detail and supporting evidence as possible included or attached (https://wmich.edu/conduct/honesty/faculty-staff). Your course supervisor may be the appropriate person to bring the charges.

For in-class exams or quizzes, careful proctoring goes a long way towards preventing academic integrity issues. However, if you catch a student cheating during an exam, do not confront them right then. Do not take an exam from a student because you suspect them of cheating, or impose penalties for cheating, unless you have charged the student through the OSC, and the student has been found responsible. You may ask the student to hand over a crib sheet, or a cell phone during

an exam, or to change seats. If the student does not comply, inform them that they are at risk of being charged with a Student Code of Conduct violation, document the details, and charge them afterwards.

Unable to Teach

Should you be unable to teach a class due to an illness or some other reason, you should follow instructions given to you by the course supervisor. If you are teaching your own class, you should immediately contact the Department secretary to see if arrangements can be made to get a substitute instructor for your class. As a rule, we only cancel class as a last resort. So, please provide as much advance notice to the course supervisor or the Department secretary as you can.

Teaching Techniques

Everyone's style of teaching is unique, and there are lots of different ways to be a good teacher. However, no matter how good a teacher is, there is always room for improvement. Please keep in mind that it is already clear that you, the instructor, know more about the class material than your students. Therefore, it is unnecessary to establish your superiority over your students. If your students feel that you respect them, they will enjoy coming to class and ask questions more freely and frequently. Students should not be criticized for asking "dumb" questions.

In terms of some basics, you should consider your use of the board or other media when teaching. You should plan ahead for this by actually writing in your lesson plan what you anticipate writing on the board during class, when you should be able to remove any information you have placed on the board, and what parts you plan to leave up for the entire class. You should always think about ease of reading what is on the board and make an effort to maintain oral communication while writing on the board.

With regard to more complex issues related to teaching, it is the case that there are many different approaches one may use to engage students. Whether you are teaching through demonstration (lecture), questioning and answering (interactive lecture), or small group work followed by whole class discussion, there are a few things that many good teachers seem to have in common, and you should keep these in mind.

1. *Pose good questions for students to consider*. This will engage students differently in the material than having students only be spectators, watching you do work on the board, document camera, or any media. These questions should provoke thinking by not being ones that can simply be answered with a yes or no or by filling in the blank, and have some potential for debate or discussion. Planning these types of questions before teaching and considering when they should be posed is essential for using this approach effectively. You may want to watch a short clip of an interactive lecture of this type by Deborah Ball, formerDean of the College of Education at the University of Michigan, at the following web address: http://www.youtube.com/watch?v=pPhCmvpPorU. She provides simple tips on how to encourage students to participate in this format and reasons for doing so.

2. *Encourage students to ask questions*. If questions are encouraged, students will be held more accountable for listening carefully to what happens in class and to determine for themselves what they do and do not understand. On occasion, a student will tell you that he/she is "completely lost" and may not be able to pose a question. In this case, you can try to find some starting point that the student does understand and then perhaps engage the class in sharing a few important ideas that could help the student gain more clarity. Do this in situations where the whole class will benefit from the conversation.

3. *Engage students in analyzing the thinking of their peers*. Focus on student thinking by utilizing their work, strategies, and reasoning during discussions of material. One important goal is to allow sharing of both correct and incorrect thinking during class discussions. Asking the class to analyze erroneous thinking can be a productive way to encourage students to identify common misconceptions so they know what to avoid and why. Related to this is encouraging students to share ideas or claims that they are unsure about for their classmates to consider. A simple example that occurred in an algebra class here on campus was when students were analyzing the relationship between measurements of temperature in Fahrenheit and Celsius. One student noticed that when you have 0° Celsius and use the equation $F = 9/5C + 32$, $F = 32º$. She then made a claim that for every degree increase in Celsius, you would get a 32-degree increase in Fahrenheit. While the instructor could have easily stepped in and explained why this was not true, encouraging classmates to provide arguments to disprove this claim was beneficial as it required them to think more about the meaning of the coefficient (slope) in the equation and ways to articulate the actual relationship modeled in that equation.

Evaluation of Your Teaching

Your teaching mentor is a faculty member from the Mathematics Department who will serve as a resource for you and submit a report to the Instructional Committee about their observation of your teaching. Teaching mentors are assigned each semester mainly based on schedules, so you may have a different mentor each semester. The teaching mentor will visit your class at least once during the semester and produce a report that gives their evaluation of your teaching. **You should contact this mentor and introduce yourself soon after they are assigned to you**, and discuss how the classroom observation will be conducted. After the classroom observation, you should meet with the mentor to discuss your teaching, to talk about your strengths as well as those aspects that need improvement. If you have any problems or concerns about your teaching, both your mentor and your course supervisor are good people to talk to.

Every session or semester your students will also evaluate your teaching using an online evaluation form that contains general questions generated by the Campus Labs Student Course Ratings System (CLCRS). You may be able to add questions from among a collection offered by CLCRS if you are the instructor of record. If this is the case, you will receive an email from CLCRS asking you to approve your evaluation form or add questions. This must be done under the deadlines provided in the email. If you are teaching a discussion section, it is likely that the course supervisor will make those decisions. In any case, the purpose of these evaluations is to determine areas that may require some additional work and improvement on your part.

Teaching Award

The Department has been very fortunate to have a large number of very good teachers among its graduate teaching assistants, and we hope to continue this record. Occasionally, a graduate assistant's teaching is so outstanding that they receive special recognition from the Department. The Charles H. Butler Excellence in Teaching Award exists for this purpose (see the Awards section for more details).

XVI. SUBSTITUTE TEACHING FOR FACULTY

Faculty members in the Department of Mathematics sometimes need someone to teach their classes during their absence. Typically, an arrangement will be made with another faculty member to cover these classes. However, sometimes a (more advanced) graduate student may be asked to do this teaching. Although this can provide valuable experience for the graduate student, the following points should be kept in mind:

- The student is under no obligation to accept such a request from a faculty member.
- In order to shield the student from any undue pressure from a faculty member to accept these extra teaching duties, this kind of teaching arrangement must have prior approval of the Chair of the Department.
- In some cases, the graduate student is entitled to appropriate compensation for additional teaching. Such compensation requires approval by the Chair of the Department prior to the start of the substitute teaching.

There may be similar instances where faculty want to offer graduate students additional professional experiences that require the students to go beyond their normal workload: e.g., helping to organize a conference or a workshop or helping to manage the activities of a long-term visitor to the Department. Guidelines analogous to those above also apply in such situations.

APPENDIX A

DOCTORATES AWARDED IN THE DEPARTMENT OF MATHEMATICS

	Doctorate Position	Dissertation Title	Advisor; Commencement Date
1	Kenneth L. Pothoven University of South Florida	Characterizations of Some Functors of Categories of Banach Spaces	Kung-Wei Yang December 1969
2	John A. Mitchem San Jose State University	On External Partitions of Graphs	Gary Chartrand April 1970
3	Wayne W. Bishop California State University, Los Angeles	A Theory of Multiplicity for Multiplicative Filtrations	John W. Petro April 1971
4	Maurice L. Eggan Trinity University, San Antonio, Texas	Discrete Approximations to Continuous Optimal Control Problems	Arthur W. J. Stoddart April 1972
5	Pascal D. Mubinga Returned to Zaire	Convergence Bounds in Optimization	Arthur W. J. Stoddart April 1972
6	Alan A. Bishop	Completion of Lattices with Semicomplementation	Erik A. Schreiner August 1972
7	Timothy B. Carroll Eastern Michigan University	Severance Classes and Multiplicative Arithmetic Functions	Anthony A. Gioia April 1973
8	Donald W. VanderJagt Grand Valley State University	Local Connectivity in Graphs	Gary Chartrand April 1973
9	Krishnamachari S. Nadathur Bishop Herber College, India (retired)	Linear Operators Between Nonarchimedian Banach Spaces	Kung-Wei Yang August 1973
10	James E. Williamson University of Dubuque	On Hamiltonian-Connected Graphs	Gary Chartrand August 1973
11	Kenneth G. Hummell Eureka Company	The Automorphism Group of the Wreath Product of Finite Groups	Joseph T. Buckley August 1974
12	Linda M. Lesniak Drew University	On the Theory of Hamiltonian Graphs	Gary Chartrand August 1974
13	John A. Roberts University of Louisville	Indegrees, Outdegrees, and the Hamiltonian Theme	Gary Chartrand August 1975
14	Saul Stahl University of Kansas	Self-Dual Embeddings of Graphs	Arthur T. White August 1975
15	Kenneth P. Johnson Grand Valley State University	Symmetric Maps of S3 onto a Homotopy 3-sphere	Alden H. Wright August 1975

16	Brian L. Garman University of Tampa	Cayley Graph Imbeddings and the Associated Block Designs	Arthur T. White August 1976
17	James M. Benedict Augusta State University, Georgia	On Ramsey Numbers Defined by Factorizations of Regular Complete Multi-partite Graphs	Gary Chartrand August 1976
18	H. Joseph Straight SUNY, College at Fredonia	Partitions of the Vertex Set or Edge Set of a Graph	Don L. Lick August 1977
19	Jerome J. Przybylski Elmira College, New York	On a System of Nonlinear Ordinary Differential Equations with an Irregular Type Singularity: A Degenerate Case	Philip Hsieh August 1978
20	Nancy J. Boynton SUNY, College at Fredonia	Markovian Multiserver Queuing Systems with Servers in Series	A. Bruce Clarke April 1979
21	Ronald J. Gould Emory University	Traceability in Graphs	Gary Chartrand August 1979
22	David Burns Ferris State University	Uniform Factorization in Graphs	Shashi F. Kapoor December 1979
23	John Frederick Fink Univ. of Michigan – Dearborn	Random Factors and Isofactors in Graphs and Digraphs	Gary Chartrand August 1982
24	Brian T. Mitchell Environmental Research Institute of Michigan	Parameter Optimization Using a Hierarchical System of Learning Automata	Dion Kountanis August 1982
25	Sergio Ruiz Deceased	On Isomorphic Decompositions of a Graph	Gary Chartrand December 1983
26	John G. Gimble Univ. of Alaska Fairbanks	The Chromatic and Cochromatic Number of a Graph	Linda M. Lesniak April 1984
27	John M. Rahn Western Michigan University	On the Genus of a Block Design	Arthur T. White August 1984
28	Hung Bin Zhou Intermagnetics General Corp.	On Common Subgraphs	Gary Chartrand December 1985
29	John A. Kapenga Western Michigan University	Jacobi Moments in Applied Mathematics and Computer Science	Philip Hsieh August 1986
30	Ortrud R. Ollermann University of Winnipeg	Generalized Connectivity in Graphs	Gary Chartrand August 1986
31	Farhad Shahrokhi University of North Texas	Design and Analysis of Efficient Routing Algorithms	Donald W. Matula December 1986
32	Thomas J. Vidmar Pharmacia and Upjohn	Design and Analysis of Drug Combination Experiments	Joseph W. McKean April 1986
33	James Buddy Davis Radford University	Robust Rank Analysis for Multivariate Linear Models	Joseph W. McKean April 1987
34	Zhuguo Mo Returned to China	Graph and Directed Graph Augmentation Problems	Kenneth L. Williams June 1988
35	Garry L. Johns Saginaw Valley State Univ.	Generalized Distance in Graphs	Gary Chartrand August 1988

36	Paresh J. Malde	Chromatic Partitions	Allen J. Schwenk December 1988
37	Charlene E. Beckmann Grand Valley State University	The Effect of Computer Graphics Use on Student Understanding of Calculus Concepts	Dwayne E. Channell April 1989
38	Karen S. Holbert Grand Valley State University	Specified Subgraphs and Subgraph-defined Parameters in Graphs	Gary Chartrand April 1989
39	Lee D. Witt Davenport College	Coefficients of Multiple Determination Based on Rank Estimates	Joseph W. McKean April 1989
40	Grzegorz Kubicki University of Louisville	Greatest Commons Subgraphs	Gary Chartrand August 1989
41	Eva Kubicki University of Louisville	The Chromatic Sum and Efficient Tree Algorithms	Allen J. Schwenk August 1989
42	Sudhakar H. Rao Schering-Plough Research Institute, Kenilworth, NJ	Measures of Partial Association Based on Rank Estimates	Gerald L. Sievers August 1989
43	Robert G. Rieper	*The Enumeration of Graph Imbeddings*	Arthur T. White August 1990
44	Sonlin Tian Central Missouri State Univ.	*On Distance in Graphs and Digraphs*	Gary Chartrand August 1990
45	Bruce P. Mull Lake Michigan College	*Enumerating the Orientable 2-Cell Imbeddings of Complete n-Partite Graphs*	Arthur T. White August 1990
46	Thomas B. Sprague Cornerstone University	*Shape Preserving Piecewise Cubic Interpolation*	Dennis D. Pence August 1990
47	Jamal H. Nouh Birzeit University, West Bank	*Improving Network Reliability*	Alfred J. Boals December 1990
48	Ghidewon Abay Asmeron Virginia Commonwealth Univ.	*Graph Products and Covering Graph Imbeddings*	Arthur T. White December 1990
49	Héctor Hevia Universidad Católica de Valparaiso, Chile	*A Representation of Chemical Reactions by Labeled Graphs*	Gary Chartrand June 1991
50	Elzbieta B. Jarrett Modesto Junior College	*Transformations of Graphs and Digraphs*	Gary Chartrand June 1991
51	David L. Craft Muskingum College	*Surgical Techniques for Constructing Minimal Orientable Imbeddings of Joins and Compositions of Graphs*	Arthur T. White June 1991
52	Hung-Ir Li Eli Lilly Company	*On Rank Procedures for the Logistic Model*	Joseph W. McKean December 1991
53	Jiuziang Liu Eastern Michigan University	*Maximal and Maximum Independent Sets in Graphs*	Yousef Alavi June 1992
54	Hang Chen Central Missouri State Univ.	*Common Moment Sets of Complementary Graphs*	Allen J. Schwenk June 1992

55	Himli Yahya	*A Progressive Disease Model for Doubly-censored Bivariate Survival Data that Accommodate Covariate Information*	Daniel Mihalko August 1992
56	Kimberly Tucker Perry Pharmacia and Upjohn	*A Critical Examination of the Use of Preliminary Tests in Two-sample Tests of Location*	Michael R. Stoline August 1992
57	Ignatious E. Vakalis Capitol University	*Multivariate Quadrature on MIMD Machines with Shared or Distributed Memory*	Elise DeDoncker August 1992
58	Sherry Dixon National Center for Lead-Safe Housing	*Rank Based Procedures in the Heteroscedastic Linear Model*	Joseph W. McKean December 1993
59	Steven Winters Univ. of Wisconsin-Oshkosh	*Distances Associated with Subgraphs and Subdigraphs*	Gary Chartrand June 1993
60	Brian A. Keller Iowa State University	*Symbol Sense and Its Development in Two Computer Algebra System Environments*	Christian R. Hirsch August 1993
61	Ian Campbell Walters, Jr. D'Youville College	*Isospectral Graphs and the Expander Coefficient*	Allen J. Schwenk June 1994
62	Stavros Costa Pouloukas Cyprus College, Cyprus	*Comparisons of Several Medians in a Lognormal K-sample Context Where Some Date may be Left-censored*	Michael Stoline August 1994
63	Reza Rashidi MCI, Tysons Corner, VA	*The Theory and Applications of Stratified*	Naveed Sherwani December 1994
64	Fan Cong Ford Motor Company	*Semi-Strongly Regular Graphs and Generalized Cages*	Allen J. Schwenk April 1995
65	Feipeng Xie Blue Cross & Blue Shield of Massachusetts	*Asymptotic Diagonalizations of a Linear Ordinary Differential System*	Philip Hsieh April 1995
66	Esther Joy Tesar Educational Testing Services	*Probability Polynomials for Cubic Graphs in the Framework of Random Topological Graph Theory*	Arthur T. White May 1995
67	Quan Yue State Farm Insurance Bloomington, IL	*Efficient Dominating Sets in Oriented Trees*	Allen J. Schwenk June 1995
68	Kelly Lynne Schultz Academic Talented Youth Program, Kalamazoo, MI	*Step Domination in Graphs*	Gary Chartrand June 1995
69	Heather Gavlas Grand Valley State University	*A Graph Theoretic Study of the Similarity of Discrete Structures*	Gary Chartrand June 1996
70	Michelle Schultz University of Nevada at Las Vegas	*Random Cayley Maps*	Arthur White June 1996

71	Mei Huang Wang Pharmacia and Upjohn	*Statistics Graphics: Applications to the R and GR Methods in Linear Algebra*	Joseph McKean December 1996
72	Allen Emerson Wells College, Aurora, NY	*Gender Discourse in Small Learning Groups of College-level Developmental Mathematics Students*	Christine Browning December 1996
73	Robert Vandell Indiana University-Purdue University, Fort Wayne	*Integrity of Digraphs*	Lowell Beineke December 1996
74	Jeffrey Terpstra North Dakota State University	*A Robust Estimate for an Autoregressive Time Series*	Joseph McKean April 1997
75	Daniel Cheung State Farm Insurance Agency Kalamazoo, MI	*Estimating IBNR Reserves with Robust Statistics*	Joshua Naranjo April 1997
76	Lisa Hansen Western New England College	*Domination in Digraphs*	Gary Chartrand June 1997
77	James Kett Singapore American School	*A Portrait of Assessment in Reformed Mathematics Classrooms*	Christian Hirsch December 1997
78	Richard Low San Jose State University	*Units in Integral Group Rings for Direct Products*	Joseph Buckley June 1998
79	Myeong Joon Ann	*Perturbed Hamiltonian System of Two Parameters with Several Turning Points*	Philip Hsieh June 1998
80	Melanie King Wahlberg The College of New Jersey	*The Effects of Writing Assignments on Second-semester Calculus Students: Understanding Sense*	Christine Browning June 1998
81	Ramon Figueroa-Centeno Pittsburg State University, Pittsburg, KS	*Surface Models of Finite Geometries*	Arthur White June 1998
82	Pam Crawford Jacksonville University, FL	*Fostering Reflective Thinking in First Semester Calculus Classes*	Christian Hirsch June 1998
83	Dawn Jones Keuka College, Keuka Falls, NY	*A Generalization of Cayley Graphs for Finite Fields*	Arthur White August 1998
84	Rebecca Walker Guttman Community College, NY	*Students' Conceptions of Mathematics and the Transition from Standards-based Reform Curriculum to College Mathematics*	Christian Hirsch December 1999
85	David Coffey Grand Valley State University, MI	*An Investigation Into Relationships Between Alternative Assessment and Pre-Service Elementary Teachers' Beliefs About Mathematics*	Christine Browning June 2000

86	Linda Eroh University of Wisconsin, Oshkosh	*Rainbow Ramsey Numbers*	Allen Schwenk June 2000
87	David Zeitler	*Empirical Spectral Analysis of Random Number Generators*	Joseph McKean June 2001
88	Boyd Jay Hanson	*A Comparison of Methods for Detection of Qualitative Interaction in Multicenter Trials*	Michael Stoline March 2001
89	Mary Lynn Breyfogle Bucknell University	*Changing Mathematical Discourse: A Case of a Secondary School Mathematics Teacher*	Laura Van Zoest July 2001
90	David J. Erwin Trinity College	*Cost Domination in Graphs*	Gary Chartrand April 2001
91	Peter Atwood Cornerstone University	*Learning to Construct Proofs in a First Course on Mathematical Proofs*	Christian Hirsch July 2001
92	Jonathon K. Hodge Grand Valley State University	*Separable Preference Orders*	Allen Schwenk 2002
93	Varaporn Saenpholphat Srinahkarinwirot University	*Resolvability in Graphs*	Ping Zhang April 2002
94	Paula T. Smith	*Local Symmetries of Symmetrical Cayley Maps*	John Martino April 2002
95	Marcia L. Weller Weinhold Purdue University-Calumet	*How Teachers Construct an Understanding of "Appropriate Use" of Graphing Calculators in the Context of Collegial Inquiry*	Christian Hirsch July 2003
96	Kirsty Eisenhart Western Michigan University	*Multiobjective Optimal Control Problems with Endpoint and State Constraints*	Qiji (Jim) Zhu March 2003
97	Jihwa Noh University of Northern Iowa	*An Investigation of Secondary Teachers' Knowledge of Rate of Change in the Context of Teaching a Standards-Based Curriculum*	Kate Kline and Steve Ziebarth July 2004
98	Kathryn G. Shafer Bethel College	*Two High School Teachers' Initial Use of Geometer's Sketchpad: Issues of Implementation*	Tabitha Mingus November 2004
99	Paritwtaana Pacheenburawana Thummasat University	*The Global Optimality Conditions in Mathematical Programming and Optimal Control*	Yuri Ledyaev December 2004
100	Ralucca Gera Naval Postgraduate School	*Stratification and Domination in Graphs and Digraphs*	Ping Zhang November 2004
101	Archara Chaiyakarn Thummasat University	*Structure Preserving Algorithms for Computing the Symplectic Singular Value Decomposition*	Niloufer Mackey November 2004
102	Joseph Fox Salem State College	*Nilpotent Orbits on Infinitesimal Symmetric Spaces*	Terrell Hodge March 2006

103	Sheri Stockero Michigan Technological University	*The Effect of Using Video Cases of Mathematics on Preservice Teachers' Development of a Reflective Stance Towards Teaching*	Laura Van Zoest June 2006
104	Henry Escuadro Juniata College	*Detectable Colorings of Graphs*	Ping Zhang January 2006
105	Futaba Okamoto University of Wisconsin – La Crosse	*Measures of Traversability in Graphs*	Ping Zhang, April, 2007
106	Ovidiu Furdui University of Toledo	*The Fock Space and Related Bergman Type Integral Operators*	John Srdjan Petrovic June 2007
107	Nesrin Cengiz University of Michigan – Dearborn	*What Allows Teachers to Extend Student Thinking During Whole Group Discussions?*	Theresa Grant and Kate Kline August 2007
108	Dana Cox Miami University	*Understanding Similarity: Bridging Numeric and Geometric Strategies for Proportional Thinking*	Steve Ziebarth and Jane-Jane Lo June 2008
109	Sandra Madden University of Massachusetts, Amherst	*High School Mathematics Teachers' Evolving Understanding of Comparing Distributions*	Christian Hirsch, August 2008
110	Anirban Dutta Letse, LLC	*Option Pricing and Stable Trading Strategies in the Presence of Information Asymmetry*	Qiji (Jim) Zhu April 2010
111	Allan Bickle Dordt College	*The K-Core of a Graph*	Allen Schwenk December 2010
112	Kyle Kolasinski U.S. Department of Defense	*Hamiltonicity and Connectivity in Distance-Colored Graphs*	Ping Zhang June 2011
113	Ryan Jones Grand Rapids Community College	*Modular and Graceful Edge Colorings*	Ping Zhang June 2011
114	Karen Fonkert Charleston Southern University	*Patterns of Interaction and Mathematical Thinking of High School Students in Classroom Environments that Include Use of Java-Based, Curriculum-Embedded Software*	Steve Ziebarth April 2012
115	Bryan Phinezy Epic Systems	*Variations on a Graph Coloring Theme*	Ping Zhang June 2012
116	Nicole Fonger Syracuse University	*Characterizing and Supporting Change in Algebra Students' Representational Fluency in*	Jon Davis August 2012

		CAS/Paper-and-Pencil Environment	
117	Jianwei Lin Putian University (China)	*The Domination Number of* $K_a \square K_b \square K_c$	Allen Schwenk August 2012
118	Benjamin Phillips University of Michigan-Dearborn	*Boolean and Profinite Loops*	Clifton Ealy, Jr. December 2012
119	Daniel S. Sievewright Kalamazoo College	*Weighted Shifts of Finite Multiplicity*	John Srdjan Petrovic April 2013
120	Julienne Houck	*A Pattern in the Lusternik-Schnirelmann Category of Rational Spaces*	Jeffrey Strom August 2013
121	David Arnold	*Classifying Spaces of Symmetric Groups and Wreath Products*	John Martino December 2013
122	Napthalin Achubang Atanga Cameroon Baptist Convention Education Department	*Elementary School Teachers' Use of Curricular Resources for Lesson Design and Enactment*	Ok-Kyeong Kim April 2014
123	Eric Andrews University of Alaska-Anchorage	*On Eulerian Irregularity and Decompositions in Graphs*	Ping Zhang June 2014
124	Alper Bulut Kuwait University	*Lie Loops Associated with GL(H), H a Separable Infinite Dimensional Hilbert Space*	Clifton Ealy, Jr. June 2014
125	Alden Jack Edson Michigan State University	*A Deeply Digital Instructional Unit on Binomial Distributions and Statistical Inference: A Design Experiment*	Christian Hirsch and Steve Ziebarth June 2014
126	Joshua Goss University of New Haven	*A Method for Assessing and Describing the Informal Inferential Reasoning of Middle School Students*	Christine Browning June 2014
127	Robert Kipka Queen's University	*Mathematical Methods of Analysis for Control and Dynamic Optimization Problems on Manifolds*	Yuri Ledyaev June 2014
128	Dustin O. Smith Murray State University	*Eliciting Elementary School Students' Informal Inferential Reasoning through Storytelling*	Kate Kline August 2014
129	Chira Lumduanhom Srinakharinwirot University	*Modular Monochromatic Colorings Spectra and Frames in Graphs*	Ping Zhang December 2014
130	Vasilije Perovic University of Rhode Island	*Spectrally Equivalent Matrix Polynomials: Non-Standard Bases and Preservation of Structure*	D. Steven Mackey May 2015

131	James P. Schwass	*Phantom Maps, Decomposability, and Spaces Meeting Particular Finiteness Conditions*	Jeffrey Strom May 2015
132	Daniel P. Johnston University of Montana	*Edge Colorings of Graphs and Their Applications*	Ping Zhang June 2015
133	Christina Zumbrun Trine University	*Secondary Mathematics Teachers' Attitudes and Beliefs Toward Statistics: Developing an Initial Profile*	Christine Browning and Steve Ziebarth June 2015
134	Timothy L. Clark	*Resolving Classes and Resolvable Spaces in Rational Homotopy Theory*	Jeffrey Strom June 2016
135	Elliot LaForge	*Chromatic Connectivity of Graphs*	Ping Zhang June 2016
136	James Kratky Vivint Smart Home, Signtronix	*Pedagogical Moves as Characteristics of One Instructor's Instrumental Orchestrations with Tinkerplots and the TI-73: A Case Study*	Jon Davis December 2016
137	Zhenming Bi VOBA Solutions Northeastern University	*Highly Hamiltonian Graphs and Digraphs*	Ping Zhang June 2017
138	Stephen Devereaux Cornerstone University	*Color-Connected Graphs and Information-Transfer Paths*	Ping Zhang December 2017
139	Khawlah Hamad Alhulwah Imam Mohammad University	*Structures of Derived Graphs*	Ping Zhang December 2017
140	Laars Helenius U.S. Army Engineer Research and Development Center (ERDC)	*Edge-Induced Weightings of Uniform Hypergraphs and Related Problems*	Andrzej Dudek December 2017
141	Mehdi Vazifedan TA, Western Michigan University	*No-Arbitrage Principle in Conic Finance*	Qiji (Jim) Zhu April 2018
142	Ian Hart	*Induced Graph Colorings*	Ping Zhang June 2018
143	Mary Achieng Ochieng Strathmore University	*The Bellringer Sequence: Investigating What and How Preservice Mathematics Teachers Learn Through Pedagogies of Enactment*	Laura Van Zoest June 2018
144	Alexis Byers Youngstown State University	*Graceful Colorings and Connection in Graphs*	Ping Zhang June 2018
145	Sean Joseph English University of Illinois at Urbana-Champaign	*Probabilistic and Extremal Problems in Combinatorics*	Andrzej Dudek August 2018
146	Mohra Abdullah Alqahtani	*Generalized Line Graphs*	Ping Zhang

	King Khalid University		December 2018
147	Nasreen Almohanna Imam Muhammad Ibn Saud Islamic University, Riyadh	*Uniformly Connected Graphs*	Ping Zhang May 2019
148	Drake Olejniczak Purdue University Fort Wayne	*Variations in Ramsey Theory*	Ping Zhang May 2019
149	Sagara Dewasurendra Indiana University East	*Optimum Leverage Level of the Banking Sector*	Qiju Zhu May 2019
150	Jamie Hallas Concord University	*Extremal Problems on Induced Graph Colorings*	Ping Zhang May 2020
151	Jason Gauthier Allegan Area Educational Service Agency	*Reflective Teacher Change Processes in the Presence of a Mathematical Professional Development Intervention*	Steve Ziebarth May 2020
152	Noha Adelghany	*On Codes Over Rings: The MacWilliams Extension Theorem & The MacWilliams Identities*	Jay Wood June 2020
153	Richard Holister University of Buffalo	*Inverse Problems for Polynomials and Rational Matrices*	Steve Mackey December 2020
154	Mona Aladil	*Saudi Elementary Teachers Knowledge for Teaching Fractions*	Ok-Kyeong Kim December 2020
155	Mohammad Shatnawi	*On the Local Theory of Profinite Groups*	Clifton Ealy, Jr. December 2020
156	Bethel McGrew	*From Multi-Prime Labelings to Subset Labelings of Graphs*	Ping Zhang May 2021
157	Maria Talanda-Fisher	*Dominating Functions in Graphs*	Ping Zhang May 2021
158	Ryan Cushman	*On Problems in Random Structures*	Patrick Bennett & Andrzej Dudek May 2021

APPENDIX B

GRADUATE AWARDS IN THE

DEPARTMENT OF MATHEMATICS SINCE 1999

Year	**Robert C. Seber Memorial Award** (Master's in Math Ed)	**Charles Butler Excellence in Teaching Award**	**Graduate Student Teaching Effectiveness Award**	**Department Graduate Service Award**	**Yousef Alavi Doctoral Student Award**	**Department Graduate Research Scholar Award**
1999		Kirsty Eisenhart Sheila Eisenhauer Amy Stone Asheber Abebe Joe Fox Thayma Darby			David Erwin	Linda Eroh
2000		Daniela Hernandez Jon Hodge	Asheber Abebe	Angela Root	Rebecca Walker	David Erwin
2001	Kevin Guzzo	Laila Poisson	Lynn Breyfogle	Vince Castellani	Asheber Abebe	Lynn Breyfogle
2002	Serena Kershner, Robert Nisen	Ralucca Gera Jihwa Noh	Joe Fox	John Daniels, Kirsty Eisenhart	Jon Hodge	Jon Hodge, Varaporn Saenpholphat
2003	Ellen Eisele	Nesrin Cengiz	Ralucca Gera	Michael Blake		Ralucca Gera
2004	Tamara Ashby	Henry Escuadro	Nesrin Cengiz	Michelle Isenhour	Marcia Weinhold	
2005	Andrew Busch Rachel Vanderlugt	Marcilyn Horter	Todd Thomas Ed McClure Staci Osborne	Melanie Brown	Jihwa Noh Joe Fox	Henry Escuadro
2006	Rachel Kuipers	Futaba Okamoto Ludwig Kuzma Brad Young Julie Houck	John Hecht	Joe Hopkins	Ovidiu Furdui	Shari Stockero
2007	Anna Kruizenga Jonathan Engelman	Joseph Hopkins David Arnold Violeta Kovacev-Nikolic		Jason Trowbridge	Nesrin Cengiz	Futaba Okamoto
2008	Nicole Lanie	Janice Hiner	Dana Cox	Ben Phillips	Dana Cox	Sandra Madden
2009	Hillary Smitts	Ben Phillips		Julie Houck		Anirban Dutta

Year	**Robert C. Seber Memorial Award** (Master's in Math Ed)	**Charles Butler Excellence in Teaching Award**	**Department Graduate Student Teaching Effectiveness Award**	**Department Graduate Service Award**	**Yousef Alavi Doctoral Student Award**	**Department Graduate Research Scholar Award**
2010	Ben Freeburn Maria Poppen	Meaghan Heires Rebecca Jones Vasilije Perovic	Ryan Jones	David Arnold	Nichole Fonger	Kyle Kolasinski
2011	James Kratky	Alper Bulut Kyle Kolasinski Krystin Smaka	Nicole Fonger	A.J. Edson	Kyle Kolasinski	Ryan Jones
2012	Napthalin Atanga	Feng-Chiu Tsai-Goss Daniel Sievewright	Brian Phinezy	Vasilije Perovic	Robert Kipka	Nicole Fonger
2013	Sara Dix	Eric Andrews Sara Main	Sara Main		Alden J. Edson	Daniel Sievewright
2014	Daniel Johnston Vasilije Perovic	Alden J. Edson	Eric Andrews Chira Lumduanhom Vasilije Perovic	Dustin Smith		Ginger Rohwer
2015	Isai Almeida	Timothy Clark Jennifer O'Brien Elliot Laforge Anthony Wilburn	Stephen Devereaux	Richard Hollister	James Schwass	Daniel Johnston
2016	Matthew Schnaare	Christopher Servant	Alexis Byers	Timothy Clark Laars Helenius Richard Hollister Joshua Tymkew	Elliot LaForge	Zhenming Bi* Timothy Clark Elizabeth Fraser Mehdi Vazifedan *All University Award
2017	Nikki Walworth	Taylor Crow Mary Ochieng Matthew Stodola	Jennifer O'Brien	Amy Galick Laars Helenius Christopher Servant	Alexis Byers	Drake Olejniczak
2018	Jessica Postma	Alexis Byers Ian Hart Drake Olejniczak Matthew Stodola	Kevin Coulter Jennifer O'Brien* *All University Award	Richard Hollister	Laars Helenius	Mary Ochieng Sean English* *All University Award
2019	Amanda Seiwell	Caroline Jones Maria Talanda-Fisher Jamie Hallas	Noha Abdelghany Omar Abu-Ghalyoun	Noha Abdelghany Jamie Hallas	Richard Hollister	Drake Olejniczak Jamie Hallas
2020	Raychel Figurski	Nick Christo	Bryan Bremiller Ryan Cushman* *All University Award			Ryan Cushman Jamie Hallas* Yaomingxin Lu *All University Award

APPENDIX C

2020/21 DEPARTMENT OF MATHEMATICS FACULTY

(name, degree attained and field of specialty; * denotes Graduate Faculty)

Steven W. Ziebarth,* Chair
Ph.D. University of Iowa
Mathematics Education

Patrick Bennett*
Ph.D. Carnegie Mellon University
Algorithms, Combinatorics, and Optimization

Jon Davis*
Ph.D. University of Minnesota
Mathematics Education

Andrzej Dudek*
Ph.D. Emory University
Combinatorics

Clifton E. Ealy, Jr.*
Ph.D. University of Chicago
Group Theory and Combinatorics

Gene Freudenburg*
Ph.D. Washington University in St. Louis
Affine Algebraic Geometry

Theresa Grant*
Ph.D. University of Delaware
Mathematics Education

Terrell Hodge*
Ph.D. University of Virginia
Algebra/Group Theory

Ok-Kyeong Kim*
Ph.D. University of Missouri
Mathematics Education

Kate Kline*
Ed.D. University of Michigan
Mathematics Education

Melinda Koelling*
Ph.D. University of Michigan
Differential Equations, Computational Neuroscience

Yuri Ledyaev*
Ph.D. Moscow Institute; Dr.Sc. Steklov Institute
Differential Equations

Marianna Levin*
Ph.D. University of California, Berkeley
Science and Mathematics Education

Jane-Jane Lo*
Ph.D. Florida State University
Mathematics Education

John Martino*
Ph.D. Northwestern University
Algebra and Topology

Tabitha Mingus*
Ph.D. University of Northern Colorado
Collegiate Mathematics Education

John Petrovic*
Ph.D. University of Michigan
Functional Analysis

David Richter*
Ph.D. University of Minnesota
Mathematical Physics, Geometry

Jeffrey Strom*
Ph.D. University of Wisconsin
Algebraic Topology

Jay S. Treiman*
Ph.D. University of Washington
Optimization

Laura R. Van Zoest*
Ph.D. Illinois State University
Mathematics Education

Ping Zhang*
Ph.D. Michigan State University
Combinatorics

Qiji Zhu*
Ph.D. Northeastern University
Analysis