

Program Cover Sheet --- MAT 200: Proof Writing through Discrete Mathematics

I. Basic Course Information

MAT 200 is primarily an introduction to proof course. It teaches proof using topics from discrete mathematics. It is intended to be first-year course for prospective mathematics majors. It will be scheduled for two 80-minute lecture periods and a 50-minute recitation devoted to proof-writing activities. It has MAT 127: Calculus A as a co-requisite.

II. Learning Goals

The primary goal of this course is to teach prospective majors how to read and write mathematics by teaching how to write proofs. Proofs are humanity's attempt to determine the meaning of the word truth. Our students should be able to formulate and express ideas in the precise mathematical language, in thoughtfully reasoned and carefully worded arguments.

This course is an investigation of the nature of proofs and the language of theoretical mathematics. The mathematical content used to teach these skills is chosen from topics in the field of mathematics known as discrete mathematics. Objects in discrete mathematics are simple and intuitive, making it possible for the emphasis to be on the style and notation. This course will use the topics in discrete mathematics to teach proof techniques.

III. Student Assessment

Students will receive regular feedback on their work through frequent writing assignments as well as other homework, quizzes, student presentations and examinations. Through this feedback, students will be able to see and correct their misunderstandings and improve their performance. Student performance on these assessment instruments and the performance of students in their future courses such as MAT 205: Linear Algebra, and higher level 300- and 400-level courses will be used to assess the success of MAT 200 in achieving its learning goals. MAT 200 will also be assessed based upon its contribution to the fulfillment of the program goals for the Liberal Arts Mathematics, Applied Mathematics, Mathematics Secondary Education, and Statistics programs. Peer reviews and student evaluations will also be used to evaluate the course.

IV. Learning Activities

Learning activities will consist of a combination of lectures, writing activities, group work, and student presentations. The specific choice will depend upon the individual instructor, but writing activities should constitute a significant portion of student work. Outside of class, students are expected to do a significant amount of individual and group homework to achieve the learning goals. These learning activities are typical of the learning activities in the department's majors and specializations. By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of the concepts of discrete mathematics and contribute to the learning goals of these programs.

Departmental Course Syllabus --- MAT 200: Proof Writing through Discrete Mathematics

Introduction: A typical syllabus for MAT 200 follows this sheet. Any syllabus for MAT 200 should include the points listed below (the required course requirement sections).

I. Basic information on course and instructor

- A. Purpose statement: The course's primary goal is to develop a student's ability to understand the language of abstract mathematics. This includes the ability to interpret and create formal definitions, to formulate, read, write and critique proofs and to read and write mathematical prose. These skills will be practiced and mastered as students are introduced to the basic concepts of discrete mathematics. The course should provide a firm foundation in the composition of proofs preparing students for upper level mathematics courses such as Linear and Abstract Algebra.
- B. Course description: The course will cover the following specific topics: mathematical notation, logic, truth tables, direct proofs, indirect proofs, proof by contradiction, proof by cases, mathematical induction (weak and strong), contrapositive proofs, definitions and properties of functions and relations, cardinality, proofs of one-to-one and onto properties, proofs of set equality, and a brief introduction to graph theory. In addition to teaching logic, functions, and relations, instructors will teach proof with examples taken from three to four areas of discrete mathematics including set theory, number theory, sequences and recursion, and a fourth area at the discretion of the instructor. However, the main goal of the course is student mastery of proof techniques and not an exhaustive coverage of topics from discrete mathematics.
- C. Course co-requisite: MAT127: Calculus A.

II. Learning goals

- A. Content goals: Students will learn the foundational skills of logic and proof techniques. Students will also gain acquaintance with several of the basic topics in elementary discrete mathematics listed above.
- B. Performance goals: At the completion of the course, students should demonstrate competence with logical thinking and the use of various proof techniques. A successful student should be able to read and write formal mathematical statements such as definitions and the statements of theorems. They should be able to compose proofs from intuitive ideas and outlines. Their exposition should be mathematically correct, logically organized and stylistically clear. They should also be able to read mathematical prose, interpret it at an intuitive level, critique its style, determine its base assumptions and mathematical accuracy. They should also demonstrate competence with various concepts from discrete mathematics.

III. Student assessment

- A. Assessment plan: Students will receive regular feedback on their work through frequent writing assignments as well as the assignment of other homework, quizzes, projects, student presentations and examinations. A syllabus should clearly describe the schedule for these assessment tools and how they will be used to calculate grades. It is expected that writing activities will constitute a significant portion of student work and grades.
- B. Rationale: Through the use of regular feedback from writing assignments and other homework, quizzes, student presentations and examinations, students will be able to see and correct their misunderstandings and improve their performance.
- C. Methods and criteria: We will use the assessment of homework, quizzes, projects, student presentations, and examinations to evaluate student accomplishment of the course learning goals. These assessment tools are similar to the manner in which students will need to use their knowledge in the future of and are an appropriate way to assess the accomplishment of course learning goals.

IV. Learning activities

- A. Summary of learning activities: Learning activities will consist of a combination of lectures, frequent writing assignments, group work, and student presentations. The specific choice of activities will depend upon the individual instructor but will necessarily include writing. Outside of class, students are expected to do a significant amount of individual and group writing to achieve the learning goals.
- B. Calendar or outline: A guide to the organization of the course, a schedule of assessment tools, and a plan for the coverage of topics should be provided to the students. Homework, quizzes, and examinations should be spaced at appropriate intervals throughout the semester.
- C. Rationale By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of discrete structures and the language of mathematics and contribute to the learning goals of these programs. A regular spacing of assessment tools insures that students receive continual regular feedback on their work.

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