Program Cover Document --- MAT 125: Calculus for Business and the Social Sciences

I. Basic Course Information

A course intended for majors in Business and the Social Sciences, and/or minors in Statistics. Topics include differential calculus, integral calculus and some multivariable calculus, with applications to areas of business and social science. The prerequisite is MAT 119: Introduction to Functions or MAT 120: Precalculus. Not for mathematics majors.

II. Learning Goals

The primary emphasis of MAT 125 is on learning the practical and applied aspects of calculus. Its subject matter is intended to form part of the mathematical foundation for courses in business and the social sciences and 300 level courses in statistics.

The major topics covered are derivatives, the rules and applications of differentiation, integrals, and applications of integrals. Upon completion of the course, we expect students to show competence with the major ideas of calculus, to understand how to apply calculus to solve real-world problems, to exhibit an improved ability to describe and solve a real-world problem mathematically, particularly for problems arising in business and economics. These performance goals are in agreement with the program goals of degree programs in the School of Business.

In MAT 125, students will primarily gain exposure to the applied aspects of calculus. They will of necessity learn theory, but the emphasis will not be on using the theory to rigorously prove abstract mathematical results. Instead, the emphasis will be on how the theory relates to concepts in the Social Sciences and problem-solving. By working on real-life problems, students will gain an appreciation for the practical applications of calculus. They are also exposed to the concepts and techniques of problem solving through individual and group work on the exercises.

MAT 125 will develop a higher degree of understanding in its students than they have learned in high-school curricula. Many courses in Business and the Social Sciences require a higher degree of quantitative reasoning, particularly with respect to mathematical modeling of real-world problems, than is usually taught in the high school curriculum. As incoming students form the majority of the class, an important goal of MAT 125 is to raise the level of their mathematical reasoning skills to the collegiate level.

III. Student Assessment

Students will receive regular feedback on their work through the assignment of 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 Economics will be used to assess the success of MAT 125 in achieving its learning goals and its contribution to the fulfillment of the program goals in the Social Sciences and the School of Business. 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, group work, student presentations, text assignments, and assignments using graphing calculators or computers. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of homework to achieve the learning goals. By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of the concepts of calculus and contribute to the learning goals of these programs that this course serves.

Course Syllabus Guide --- MAT 125

Introduction: A typical syllabus for MAT 125 follows this sheet. Any syllabus for MAT 125 should include the points listed below (the required course requirement sections) and use the recommended topics list as the basis for decisions on the course content.

I. Basic information on course and instructor

A. Purpose statement: MAT 125 is a foundational course for curricula in the School of Business and the Social Sciences. It introduces students both to calculus and the higher expectations of college-level mathematics courses and should give them the mathematical tools they need to succeed in those courses.

B. Course description: This course provides students with a solid grounding in the main aspects of calculus. The course is designed for students in the Social Sciences and the School of Business. Topics include the major aspects of differential and integral calculus, some multivariable calculus, and the uses to which these are put. It differs from MAT 127 (the calculus course for science, mathematics and engineering majors) in that there is less focus on theory, more focus on business applications, and a narrower range of topics. In particular, MAT 125 does not cover trigonometric, inverse trigonometric or hyperbolic trigonometric functions, which are covered in MAT 127, and MAT 127 does not necessarily cover topics such as marginal cost/profit or continuous interest which are covered in MAT 125.

C. Course prerequisites: MAT 119 or MAT 120.

II. Learning goals

A. Content goals: The choice of topics covered and their emphases should be based upon the attached recommended topics list.

B. Performance goals: At the completion of the course, students should show competence with the ideas of calculus and its computations, to understand how to apply calculus to solve real-world problems, to exhibit an improved ability to describe a real-world problem mathematically, to have an increased mathematical maturity, and to have an improved ability to read, write, and understand mathematics.

III. Student assessment

A. Assessment plan: Students will receive regular feedback on their work through multiple sources, which can include homework, online assignments, quizzes, student presentations and examinations. A syllabus should clearly describe the schedule for these assessment tools and how they will be used to calculate grades.

B. Rationale: Students need to be able to use calculus correctly in their future courses. Through the use of regular feedback from a variety of sources, 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, 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 display their knowledge of calculus in the future and are an appropriate way to assess the accomplishment of course learning goals.

IV. Learning activities

A. Summary of learning activities: Learning activities may consist of a combination of lectures, group work, student presentations, and assignments using computers or graphing calculators. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and group homework 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. As an approximate guide, 1-2 topics on the recommended list can be covered in a class period. 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 the concepts of calculus and contribute to the learning goals of these programs. A regular spacing of assessment tools insures students' continual regular feedback on their work.

MAT 125 Topics List

All listed topics are to be covered. Topics in bold should be covered in depth.

1. Review of Precalculus
2. **Introduction to limits – numerical and graphical approach**
3. **Algebraic approach to limits, and concept of continuity**
4. **Tangent lines to curves, introduction to differentiation**
5. **Differentiation techniques – power rule, product rule, quotient rule**
6. **The Chain rule**
7. **Higher order derivatives**
8. **Increasing, decreasing, concave up and concave down functions**
9. Asymptotes and Rational Functions
10. **Determining absolute maximum and minimum values using derivatives**
11. **Max/Min problems in Business and Economics**
12. **Marginals and Differentials (including marginal cost, profit)**
13. **Exponential functions – derivatives and graphs**
14. **Logarithmic functions – derivatives and graphs**
15. **Applications: Exponential growth and decay**
16. **Derivatives of $y = a^x$ and $y = log_a x$**
17. **Elasticity of Demand**
18. **Antidifferentiation**
19. Area under a curve and Riemann sums
20. **Fundamental Theorem of Calculus**
21. **Properties of Definite integrals (including area between curves)**
22. **Substitution**
23. **Applications: Consumer Surplus and Producer Surplus**
24. **Applications: Present Value and Future Value**
25. **Functions of Several Variables**
26. **Partial Derivatives**

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