TRUMBULL PUBLIC SCHOOLS

TRUMBULL, CONNECTICUT

MATHEMATICS CURRICULUM

Calculus 400

Spring 1992

Writing Team:
Nial Neger
Mary Quinlan

Edward C. Lovely
Supervisor of Curriculum Development

TABLE OF CONTENTS
Calculus 400

The Trumbull Board of Education as a matter of policy, prohibits discrimination on the grounds of age, creed, religion, sex, race, color, handicap, political affiliation, marital status or national origin

Philosophy
Calculus 400

Calculus 400 is designed for seniors who have completed Precalculus 300. It covers selected topics from a first year calculus course. Students who elect this course have a strong background in mathematics, but either are not at the very top of their class in mathematics or they do not feel that they will need a rigorous calculus course in the future. Students taking this course will not be prepared to take the A.P. Test in Calculus in the Spring, and most colleges probably will not grant advanced standing in calculus for this course.

This course will cover topics in differentiation and integration as might be found in a "typical" college freshman course in calculus for non-science majors. There will be fewer topics covered in less depth than the A.P. Calculus course. There is currently much debate about a "lighter and livelier calculus" at the college level. Several colleges are experimenting with different curricula which takes a new approach to teaching calculus. Until the dust settles, we are taking a traditional approach to calculus with the exception of instructing students in the use of graphic calculators.

Prior to electing this course, students should have a good preparation in precalculus . They need to be have an understanding of the topics in precalculus as well as being very good at algebraic manipulations. Most of the mathematics they have previously studied will be employed in learning calculus. While this course is not as demanding as the A.P. Calculus course, it still requires substantial effort on the part of the student to do well. As important as mathematical knowledge and ability is the desire on the part of the students to succeed. In particular it is extremely important that they accept that they will have to work throughout the entire year and that they must keep current with the work assigned. Starting off with good intentions will not earn them a good grade if they do not persevere during the year.

Goals
Calculus 400

1. Students will strengthen their algebraic skills and their understanding of the basic functions previously studied.

2. Students will learn and use the theoretical concepts underlying calculus.

3. Students will learn and apply the process of differentation and integration.

4. Students will use calculus to solve application problems.

5. Students will further develop their ability to reason mathematically.

6. Students will strengthen their ability to express themselves mathematically in written and oral work.

Prerequisites

A grade of C or better in Precalculus 300 or 400.

Scope and Sequence
Calculus 400

I. Review of precalculus topics

II. Intuitive approach to slope of a curve and the definition of the derivative

III. Limits and continuity

IV. Definition of the derivative and introductory applications

V. Further applications of the derivative

VI. Definition and application of antiderivatives

VII. Definition of the integral

VIII. Properties and Second Fundamental Theorem

IX. Applications of the integral

X Transcendental Functions

Objectives
Calculus 400

Note: Many of the topics that follow will require either review of pertinant material or additional practice in the form of worksheets or both depending on the ability of the students. Graphing calculators are an option to be used according to their availability.

I. Review of precalculus topics

Students will:

A. Find the domain and range of a variety of functions.

B. Find and plot increments.

C. Find equations of lines given a variety of information.

D. Recognize types of functions from their equations - includes use of a graphing calculator.

E. Find zeros of a function using algebraic techniques and the graphing calculator.

F. Write formulas for sum, product, quotient and compostition of functions.

G. Find intercepts, symmetry and asymptotes of functions using both algebraic techniques and the graphing calculator.

H. State relationships between $y=f(x)$ and $y=kf(x)$, $y-k=f(x-h)$, $y=|f(x)|$, etc. with the help of the graphing calculator.

I. Find intervals from absolute value expressions.

J. Translate from inequality to absolute value.

II. Intuitive approach to slope of a curve and the definition of the derivative

Students will:

A. Find the slope of a tangent using slope of a secant.

B. Use limit notation when finding the slope of a tangent.

C. Find both average and instantaneous velocity

D. Find both average and instantaneous rate of change.

E Use the definition of the derivative to find instantaneous rates of change.

III. Limits and continuity

Students will:

A. Find the limit of a function from a graph, including the use of a graphing calculator.

B. Find the limit of a constant, sum, product, or quotient.

C. Find one-sided limits.

D. Explain why a limit is nonexistent.

E Find limits as x approaches infinity.

F. Explain why a function is discontinuous at a point.

G Explain the relationship between continuity and differentiability using the slope of a tangent line.

IV. Definition of the derivative and introductory applications

Students will:

A. Find derivatives using sum, constant, product quotient and power rules.

B. Find second derivatives and apply them to velocity problems.

C. Find derivatives implicitly.

D. Do application problems involving first and second derivatives.

E. Find derivatives using chain rule.

F. Find derivatives of all six trigonometric functions.

V. Major applications of derivatives

Students will:

A. Find intervals where a function is increasing or decreasing.

B. Find critical points and points of inflection of a function.

C. Find intervals where a function is concave up or concave down.

D. Sketch curves by hand.

E. Find vertical and horizontal asymptotes.

F. Solve max-min problems.

G. Solve related rates problems.

H. Find limits of indeterminant forms using L'Hospital's Rule.

VI. Definition and application of antiderivatives

Students will:

A. Find antiderivatives of functions of the form u^n including trig functions and the use of substitution.

B. Solve differential equations with variables separable, both with and without initial conditions.

C. Use integral notation for antiderivatives.

VII. Definition of the integral

Students will:

A. Approximate area under a curve using rectangles.

B. Find exact area above the x axis using integrals.

VIII. Properties and fundamental theorems of integration

Students will:

A. Use the five properties of integration to evaluate integrals.

B. Use the second fundamental theorem to evaluate definite integrals.

IX. Application of the integral

Students will:

A. Find the area between two curves.

B. Find volumes of solids of revolution about any vertical or horizontal line using disc and washer method.

C. Find the length of a curve.

X. Transcendental functions

Students will:

A. Find the derivative of the inverse of a function without finding the equation of the inverse.

B. Find the derivatives of inverse trig functions.

C. Take integrals leading to inverse trig functions.

D. Find derivatives of the natural logarithmic function.

E. Apply log properties to log derivatives.

F. Take integrals leading to natural log functions.

G. Use log properties to evaluate definite integrals using ln.

H. Use logarithmic differentiation and know the case where it must be used.

I. Find derivatives of the exponential function.

J. Take integrals of the exponential function.

K. Find derivatives of exponentials in the form of a^u.

L. Take integrals of exponentials in the form of a^u.

M. Find derivatives and integrals of the function $\log_a u$.

Evaluation Methods
Calculus 400

1. Student participation in class.
2. Homework
3. Quizzes
4. Teacher and publisher made unit tests.
5. Teacher and publisher made cumulative tests.
6. Mid-year and final exams based on curriculum objectives.

Suggested Time Allotment Per Unit
Calculus 400

Unit		Marking Period
I.	Review of precalculus topics	1
II.	Intuitive approach to slope of a curve and the definition of the derivative	1
III.	Limits and continuity	1
IV.	Definition of the derivative and introductory applications	2
V.	Further applications of the derivative	2
VI.	Definition and application of antiderivatives	3
VII.	Definition of the integral	3
VIII.	Properties and Second Fundamental Theorem	3
IX.	Applications of the integral	4
X	Transcendental Functions	4

Textbook
Calculus 400

Calculus and Analytic Geometry, Sixth Edition, Part I
Thomas/Finney
Addison-Wesley Publishing Co., 1987