

**VIRGINIA STATE UNIVERSITY  
DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE  
SCHOOL OF AGRICULTURE, SCIENCE AND TECHNOLOGY  
MATH 200 - CALCULUS I - 3 sem. hours  
COURSE SYLLABUS: SPRING 2004**

**Instructor's Name:** \_\_\_\_\_

**Instructor's Office Location:** \_\_\_\_\_

**Instructor's Office Phone:** \_\_\_\_\_ **Instructor's E-mail:** \_\_\_\_\_

**Departmental Fax Number: (804) 524-5746**

**Instructor's Office Hours:**

Monday	Tuesday	Wednesday	Thursday	Friday

**COURSE DESCRIPTION:**

Math 200 is the first semester sequence of a four semester sequence of calculus for students majoring in mathematics and the natural sciences majors and for others who wish to learn and apply fundamental concepts of calculus.

The goal of this course is to introduce the student to one of the two main branches of calculus, differential calculus. A major emphasis of the course consists of developing problem solving skills using differential calculus concepts and principles. The student will also construct proofs to a few selected theorems which involve a straightforward approach. The topics covered include: Lines, functions and their graphs, limits, derivatives, continuity, the theory of limits, intermediate value theorem, derivative of complete functions, power functions and trigonometric functions, implicit differentiation, related rates of change, applications of derivative, mean-value theorem and Newton's Method.

**Prerequisite: Math 121 -College Algebra and Trigonometry II**

**TEXTBOOKS:**

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CALCULUS by Larson, Hostetler and Edwards, 7th edition, 2002 Houghton Mifflin Company  
STUDENT SOLUTIONS MANUAL  
CALCULUS and the Derive Program : Experiments with the Computer, 3rd edition by Gilligan and Marquardt; Gilmar Publishing Company  
CALCULATOR - TI-82/TI-83/TI-92

## LEARNING OUTCOMES AND EVALUATION PROCEDURES

### KNOWLEDGE

The student will

1. Know the facts about straight lines, slope, and intercepts.
2. Know the forms of equations of a line.
3. Know the definition of a function and identity functional notations.
4. Define the sum, difference, product and quotient functions.
5. Define the composite function.
6. Define limit of a function informally.
7. Define one-sided limits.
8. Define the tangent line to a function.
9. Define the derivative of a function at a point  $x$ .
10. State the Intermediate Value Theorem.
11. Define differentiability on an open interval.
12. Define continuity of a function.
13. Define critical point for a function and define maxima and minima of a function.
14. Define horizontal and vertical asymptote.
15. State Rolle's theorem and illustrate graphically.
16. State the Mean Value Theorem and illustrate graphically.
17. Define the linearization of a function at a point,  $x_0$  and cite Newton's Method.

**Evaluation Strategy:** Class discussion; homework; unit test; observations; interviews and conferences.

## SKILLS

The student will

1. Find an equation of a line parallel to a given line and passing through a given point.
2. Find an equation of a line perpendicular to a given line and passing through a given points
3. Evaluate a quadratic function for certain values of the independent variable.
4. Determine if an equation defines a function.
5. Shift the graphs of functions vertically and horizontally.
6. Reflect the graph of a function about the  $x$ -axis about the  $y$ -axis, and about the origin.
7. Calculate a limit of a given function.
8. Compute a limit using a graphing utility.
9. Determine limits of polynomial functions, constant functions, constant multiples, sums, products and quotients of functions (power functions and rational functions).
10. Use the Intermediate Value Theorem to estimate the location of roots of continuous functions.
11. Compute the derivative (using the definition of derivative) of functions: linear, quadratic, radical, absolute value and piecewise defined functions.
12. Use a graphing utility to approximate a derivative.
13. Use the differentiation formulas to compute derivatives of certain functions.
14. Determine the derivative of composite functions using the chain rule.
15. Determine the derivative of a power function.
16. Find the derivative of the trigonometric functions.
17. Compute the second, third and fourth derivatives of a function

18. Use implicit differentiation.
19. Compute the equation of a tangent line by implicit differentiation.
20. Solve related rates problems as applications of the derivative.
21. Use the first derivative test to determine maxima and minima of a function.
22. Use the second derivative test to determine concavity of a function.
23. Solve applied maximum and minimum problems.
24. Determine the maximum value for the error in linear approximation.
25. Find a zero to a polynomial using Newton's method.

**Evaluation Strategy:** Class discussion; DERIVE lab assignment; Graphing utility assignments; unit test; class participation; and board work.

#### **ABILITIES:**

The student will

1. Identify the properties of parallel lines and perpendicular.
2. Identify the angle of inclination of a nonverbal line.
3. Represent function graphically
4. Identify the domain and range of a given function.
5. Use the vertical line test to identify the graph of a function.
6. Write a function as the composition of two or three functions.
7. Identify even and odd functions.
8. Identify a function for which a limit does not exist at a certain point.
9. Find infinite limits and limits at infinity.

10. Find limits from a graph.
11. Approximate a limit at infinity using a graphing utility.
12. Identify the derivative function.
13. Identify applications of the derivative as a rate of change.
14. Identify conditions for discontinuity of a function.
15. Identify implicit functions.
16. Identify horizontal and vertical tangents.
17. Identify increasing and decreasing functions.
18. Identify points of inflection for a function.
19. Identify a graph with an oblique asymptote.
20. Interpret geometrically the linearization of a function.
21. Compare Newton's method for approximating a solution to an equation with other methods such as Intermediate Value Theorem and/or Mean Value Theorem.

**Evaluation Strategy:** Homework; unit tests; DERIVE lab assignments; class discussions; and class presentations.

## **COURSE REQUIREMENTS**

1. Attend class regularly and on time.
2. Turn in written homework assignments by the due date.
3. Purchase and read the required texts and related material.
4. Purchase and learn to effectively use a TI82/83/92 graphing calculator.
5. Participate actively in class problem solving exercises.
6. Perform satisfactorily on examinations.
7. Students who are covered under the American Disability Act should privately inform the teacher of this fact so that appropriate instructional arrangements can be made.
8. All university policies specified in the Student Handbook regarding cheating, plagiarism, absenteeism, etc., will be strictly enforced. (See attached sheet on University Policies).

## **ADDITIONAL EVALUATION STRATEGIES:**

The student will be evaluated on:

1. Derive software assignment
2. Departmental comprehensive midterm examination
3. Departmental comprehensive final examination
4. Other work as assigned by the instructor
5. Tutorial computer laboratory
6. Gateway Tests

Each student's grade will be determined by the following criteria:

Midterm Average =  $\frac{2}{3}$  (Average of all work prior to the Midterm Exam) +  $\frac{1}{3}$  (Midterm Exam Score)

Final Grade =  $\frac{1}{3}$  (Midterm Average) +  $\frac{1}{3}$  (Average of all work assigned after the Midterm Exam and prior to the Final Exam) +  $\frac{1}{3}$  (Final Exam Score)

The following scale will be used:

<b>A:</b>	90 - 100
<b>B:</b>	80 - 89
<b>C:</b>	70 - 79
<b>D:</b>	60 - 69
<b>F:</b>	BELOW 60

## **TUTORIAL ASSISTANCE**

Instructor's Office -

Mathematics Laboratory – HM 209

Computer Science/Mathematics Laboratory – HM 212

Lab hours are posted on each lab office door and will be passed out in class no later than the 3rd week of class.

## **TOPICS TO BE COVERED:**

### **1. Limits**

- Introduction, Calculation of Limits
- Some Limit Theorems
- Infinite Limits and Limits at Infinity
- Continuity

### **2. Derivatives**

- Tangent Lines and Derivatives
- The Derivative as a rate of Change
- Some differentiation Formulas
- The Product and Quotient Rules
- The Derivative of Composite Functions: The Chain Rule
- The Derivative of a Power Function
- The Derivative of the Trigonometric Functions
- Higher-Order Derivatives
- Implicit Differentiation

### **3. Applications of the Derivative**

- Related Rates of Change
- Elementary Curve Sketching I: Increasing and Decreasing Functions and the First-Derivative Test
- Elementary Curve Sketching II: Concavity and the Second-Derivative Test
- Elementary Curve Sketching III: Asymptotes
- Application of Maxima and Minima
- Newton's Method for Solving Equations
- The Mean-Value Theorem
- An Application of the Mean-Value Theorem: The Linearization of a Function

## BIBLIOGRAPHY/READING LIST

HISTORY OF MATHEMATICS, by D. E. Smith, Vols. I and II, New York: Dover Publications, Inc. 1958.

AN INTRODUCTION TO THE HISTORY OF MATHEMATICS by Howard Eves, revised edition, New York: Holt, Rinehart and Winston, 1964

USING THE TI-82 TO EXPLORE PRECALCULUS AND CALCULUS. Best, G. W. And Penner, D. A. 1994, Andover Maryland: Venture Publishing.

PROGRAMMING AND PROGRAMS FOR THE TI-82 GRAPHING CALCULATOR., Brendan Kelly 1994, Brendan Kelly Publishing Inc. Burlington, Ontario. ISBN 1-89599-01-

Thomas, George G., Jr. and Finney, Ross L. CALCULUS AND ANALYTIC GEOMETRY 9th Edition, Addison Wesley Publishing Company, Reading, Massachusetts, 1996

Arney, David C., EXPLORING CALCULUS WITH DERIVE, Addison Wesley Publishing Company, Inc. 1992

Stewart, James, CALCULUS, Third edition, Brooks Cole Publishing Company, Pacific Grove, California 1995.

Edwards, C. H. Jr. and Penny, David E. CALCULUS WITH ANALYTIC GEOMETRY 4th edition, Prentice Hall, Englewood Cliff, New Jersey 1994.

Johnson, Jerry and Evans, Benue, DISCOVERING CALCULUS WITH DERIVE, Second edition, John Wiley and Son, Inc., New York, 1995

Fetta, Iris Brown, GRAPHING CALCULATOR INSTRUCTION GUIDE TO ACCOMPANY CALCULUS CONCEPTS: AN INFORMAL APPROACH TO THE MATHEMATICS OF CHANGE, D. C. Heath and Company, 1995.

LaTorre, Kenelly, Fetta, Harris and Carpenter, CALCULUS CONCEPTS AN INFORMAL APPROACH TO THE MATHEMATICS OF CHANGE, D. C. Heath and Company, 1995, Lexington MD.

Baker, William H. And Ward, James E. THE CALCULUS COMPARISON, Volume I, Jon Wiley and Sons, Inc., New York, 1992.

Solow, Anita E. PREPARING FOR A NEW CALCULUS CONFERENCE PROCEEDINGS, The Mathematical Association of America, 1994 Washington, D. C.

Finney, Thomas, Demana and Waits CALCULUS - GRAPHICAL, NUMERICAL, ALGEBRAIC, Addison Wesley Publishing Company, Reading, Mass 1994.

Swokowski, Earl W. Olinick, Michael, Pence, Dennis with the assistance of Cole, Jeffrey A., CALCULUS 6th Edition, PWS Publishing Co., Boston, MA 1994.

Larson, Hostetler and Edwards, CALCULUS WITH ANALYTIC GEOMETRY 5th edition, D. C. Heath and Company, Lexington, MA 1994.

Hollister, Herbert A. INSIGHTS INTO CALCULUS WITH THE GRAPHICS CALCULATOR, D. C. Heath and Company, Lexington, MA 1993.

Varberg, Dale and Puriell, Edwin J., CALCULUS, seventh edition, Prentice Hall, Upper Saddle River, NY, 1997.

Robert A. Wayne, CALCULUS - THE DYNAMIC OF CHANGE, The Mathematical Association of America, MAA Notes Number 39, Washington, DC

Gleason, Walter, J., IS YOUR MATH READY FOR CALCULUS, William C. Brown Publishers, Dubuque, Iowa 1993.

Best, George and Penner, David USING THE TI-82 TO EXPLORE PRECALCULUS AND CALCULUS, Venture Publishing, Andover, MD 1994

Hollister, Herbert A., INSIGHTS INTO CALCULUS WITH THE GRAPHING CALCULATOR, D. C. Heath and Co., Lexington, Massachusetts 1993.

Hades, E., Mallen, M. And Yahn, M. P. 1994 EXPLORING PRECALCULUS WITH DERIVE, West Publishing Company, St. Paul, Minn. ISBN 0 314 03892 2.

Hoening, Alan (1995) APPLIED FINITE MATHEMATICS, Houghton Mifflin Company, 2nd Edition, Boston, Massachusetts (ISBN 0-3959 63778 3)

Katz, Victor J. (1993) A HISTORY OF MATHEMATICS - AN INTRODUCTION. Harper Collins College Publishers, New York, NY (ISBN 0 673 38039 4)

**VIDEO TAPES:**

Differentiation (one and two) HOW TO ENJOY CALCULUS, by Professor Eli Pine, 90 minutes, John Wiley and Sons, 1995

Integration (one and two) HOW TO ENJOY CALCULUS, by Professor Eli Pine, 120 minutes, John Wiley and Sons, Nutley, NJ 1995

THE CREEPY CRAWLY WORLD OF CALCULUS, Part I, Cerebellum Corporation, 1995, 2 hours

THE CREEPY CRAWLY WORLD OF CALCULUS, Part II, Cerebellum Corporation, 1995, 2 hours

Fischbeck, Sally (1995) LEARNING ABOUT THE TI-82 , 85 minutes, Venture Publishing, Andover, MA

Educational Video Resources, CALCULUS - Volume Problems, Part I, Jim Williamson Productions 1992

**SOFTWARE:**

THE CALCULUS EXPLORER Intellipro, Inc. 3.5 IBM PC Version, Addison Wesley Publishing Company, 1992

CLIFFS STUDY WARE FOR CALCULUS, IBM, PC/XT, AT/PS2 Tandy and Compatibles, Cliffs Notes, Inc., Lincoln, Nebraska, 1995

## **THE GATEWAY EXAMINATION (A Calculus Reform Strategy):**

Designed to test computational skills. It is a test that students are required to pass at a specified level of proficiency (85%) in order to pass the course with at least a C grade and proceed to subsequent courses. The exam. focuses on core competencies of Calculus which no one should pass the course without knowing.

The purpose of setting a Gateway Exam with a high standard, is to assume that many students will not pass initially, and will need an opportunity to retake the examination.

The process of taking and retaking the Gateway Exam forces student to assume responsibility for learning materials which they might otherwise neglect in the belief that partial credit, assignments, classroom discussion or group work from other sections of the course will pull up their average. Each student was given a diagnostic calculus readiness test during the first week of the semester. Based on the results, he/she must retake the test until you answer correctly at least 85% (21 problems) of the 25 test questions. However, a student may receive a D/D+ grade in the course without passing the gateway examination, based on other assessment which take place within the context of the course such as homework, quizzes, projects, written tests, etc. This will also demonstrate that he/she is competent in fundamental mathematical skills necessary for Calculus The highest score on the gateway test will count as one test grade in the determination of the final grade. The Gateway test will substitute for Chapter P, preparation for calculus.

### **Direction:**

Select the best answer to each question marked. Show your work for each problem, partial credit will not be given. No credit will be given for a correct answer without an explanation.

### **Reference:**

Orr, J. L., Lewis, W. J. On Line Gateway Exams in college, Focus on Calculus, A newsletter for the Calculus consortium Based at Harvard University, John Wiley & Sons, Inc., New York, NY Winter 1998, Issue #14.