MTH 173 Calculus with Analytic Geometry I
and
MTH 174 Calculus with Analytic Geometry II

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Textbook: Calculus 8th edition by Howard Anton. John Wiley & Sons, 2005.

.Aims and Objectives:

1. To develop logical thinking skills.
2. To learn problem solving techniques (not memorization).
3. To introduce the calculus and prepare the student for the Advanced Placement Exam.
4. To prepare for college calculus and for courses which use calculus.
5. To show applications of calculus.

Course Description:

The class will meet for ninety minutes per day for the entire year. Students may earn five semester hours credit for each semester through the Lord Fairfax Dual enrollment program. All students are required to take the Advanced Placement Examination on May 3, 2006.

This course is intended for students who have a thorough knowledge of analytic geometry and elementary functions in addition to college preparatory algebra, geometry, and trigonometry. The purpose of the course is to prepare the student for advanced placement in college calculus. These standards incorporate the current College Board Advanced Placement Course Description Syllabus.

As mandated by The College Board, graphing calculators will be required for this course. Computers will be used where feasible by the student and by the teacher.

This course is a rigorous treatment of the topics of elementary calculus. Algebraic, trigonometric, exponential, and logarithmic functions will be studied, with emphasis on their properties and limits. Differential calculus will be studied and will include defining the derivative, taking the derivatives of functions, and applying the derivative to related rates problems and maxima minima problems.

The following topics of Integral Calculus will be studied: Antiderivatives; applications of antiderivatives - specifically, the area under a curve, velocity and acceleration, and volumes of solids of revolution; techniques of integration, the definite integral; and applications of the integral.

After the Advanced Placement Exam, the concepts of plane analytic geometry and those of polar coordinates will be studied.

Grading Procedures:

1. Tests

   Tests are given at the end of each chapter and sometimes in the middle of a chapter.

2. Mini Exams

   Three Mini Exams will be given during the year and will count as two test grades.
   #1 will cover Precalculus concepts and will be given during the third week.
   #2 will cover Limits and Derivatives and will be given during the second 9 weeks.
   #3 will cover Applications of derivatives and the introductory concepts of integration and will be given during the second semester.

3. Quizzes

   Quizzes are given throughout the semester to check on understanding.
   The class may begin with a “Bell-Ringer” which will be part of a quiz grade.

4. Homework

   Homework will be collected each day and will be evaluated for effort. Students should show all work. Weekly assignments are posted in three places: (1) on the board at the beginning of each week, (2) on the Blackboard Learning System, and (3) on my website. Because I believe that homework is vital to understanding mathematics, I will count the average of the homework as one test grade each nine weeks. Written homework is assigned daily (exception is the day of a test). I firmly believe that we learn by doing!

5. Class Participation

   I record classroom observations about each student (these include both positive and negative remarks - for example, answering questions, going to the board, asking questions, doing other work, etc.).

6. Semester and Final Exams

   An Exam will be given at the end of each semester and count 20% of the semester grade.
   The Final Exam will be in the A.P. Format and will be given on several days in April.

(Grading Procedures continued)

7. Extra Credit

Each week, problems will be put on the board for the students to solve and turn in for Extra credit. This problem is also posted on the Handley Math Web Page on the Internet. After most tests, logic puzzles or math activities are available for extra credit. Up to three points of extra credit may be earned during each semester.

The "test average" is determined by averaging together all the tests, mini exams, and the homework average for that particular grading period.

The "quiz average" is figured by averaging the classroom participation grade and all the quiz grades for that particular grading period.

The grade for any marking period is determined by counting the test average twice and the quiz average once.

For the eighteen weeks grade, I add on the extra credit points.

The Semester grade is found by counting the eighteen weeks grade 80% and the semester exam 20%.

Course Outline:

First Semester

I. Algebra Review
- A. Distance
- B. Slope and Angle of Inclination
- C. Equations of Lines
- D. Absolute Value
- E. Functional Notation
- F. Composite Functions

II. Limits
- A. Definition
- B. Properties
- C. Proofs of Limit Theorems

III. Derivatives of Algebraic Functions
- A. Proof of Power Formula
- B. Product and Quotient Rules
- C. Implicit Differentiation
- D. Chain Rule
- E. Derivatives of Sine and Cosine
- F. Continuity
- G. Differentials

IV. Applications of the Derivative
- A. Related Rates
- B. Maxima Minima Problems
- C. Rolle's Theorem
- D. Mean Value Theorem
- E. L'Hopital's Rule

V. Integration
- A. Indefinite Integral
- B. Applications of the Indefinite Integral
- C. Integration of Sine and Cosine
- D. Area Under a Curve
- E. Fundamental Theorem of Integral Calculus

Second Semester

VI. Applications of the Definite Integral
- A. Area Between Two Curves
- B. Distance
- C. Volumes
- D. Average Value of a Function

VII. Transcendental Functions
- A. Review Trigonometry
- B. Inverse Trigonometric Functions
- C. Properties of Logarithms
- D. Exponential Function

VIII. Methods of Integration
- A. Basic Formulas
- B. Powers of Trigonometric Functions
- C. Substitutions
- D. Integration by Parts

IX. Plane Analytic Geometry
- A. Tangents and Normals
- B. Distance Between Two Points
- C. The Conic Sections
  1. Circles
  2. Parabolas
  3. Ellipses
  4. Hyperbolas
- D. Translation and Rotation

Course Objectives (SOL Objectives are shown in parentheses)

1. The student will define and apply the properties of elementary functions, including algebraic, trigonometric, exponential, and composite functions and their inverses, and graph these functions using a graphing calculator. Properties of functions will include domains, ranges, combinations, odd, even, periodicity, symmetry, asymptotes, zeros, upper and lower bounds, and intervals where the function is increasing or decreasing. (APC.1)

2. The student will define and apply the properties of limits of functions. This will include limits of a constant, sum, product, quotient, one-sided limits, limits at infinity, infinite limits, and nonexistent limits. The student will learn the rigorous definitions of a limit. (APC.2)

3. The student will state the definition of continuity and determine where a function is continuous or discontinuous. This will include
   - continuity at a point
   - continuity over a closed interval
   - application of the Intermediate Value Theorem
   - graphical interpretation of continuity and discontinuity. (APC.3)

4. Given the appropriate information, the student will determine the slope of a curve using limits.

5. Given the equation of a curve, the student will determine the equation of the tangent and the normal to the curve.

6. The student will find the derivative of an algebraic function by using the definition of a derivative. This will include investigating and describing the relationship between differentiability and continuity. (APC.4)

7. The student will apply formulas to find the derivative of algebraic, trigonometric, exponential and logarithmic functions and their inverses. (APC.5)

8. The student will apply formulas to find the derivative of the sum, product, quotient, inverse, and composite (chain rule) of elementary functions. (APC.6)
9. The student will find the derivative of an implicitly defined function. (APC.7)

10. The student will find the higher order derivatives of algebraic, trigonometric, exponential, and logarithmic functions. (APC.8)

11. The student will use logarithmic differentiation as a technique to differentiate nonlogarithmic functions. (APC.9)

12. The student will state Rolle's Theorem and apply it to functions.

13. The student will state (without proof) the Mean Value Theorem for derivatives and apply it both algebraically and graphically. (APC.10)

14. The student will use l'Hopital's rule to find the limit functions whose limits yield the indeterminate forms: 0/0 and infinity/infinity (APC.11)

15. The student will apply the derivative to solve problems, including tangent and normal lines to a curve, curve sketching, velocity, acceleration, related rates of change, Newton's method, differentials and linear approximations, and optimization problems. (APC.12)

16. The student will find the indefinite integral of algebraic, exponential, logarithmic, and trigonometric functions. The special integration techniques of substitution (change of variables) and integration by parts will be included. (APC.13)

17. The student will learn integration by trigonometric substitution and integration by partial fractions.

18. The student will identify the properties of the definite integral. This will include the Fundamental Theorem of Calculus. (APC.14)

19. The student will apply the definite integral to solve problems. These problems will include finding distance traveled on a line and velocity from acceleration with initial conditions, growth and decay problems, solutions of separable differential equations, the average value of a function, area between curves, volumes of solids of revolution about the axes or lines parallel to the axes using disc/washer and shell methods, and volumes of solids with known cross-sectional areas. (APC.15)

20. The student will compute an approximate value for a definite integral. This will include numerical calculations using Riemann Sums, the Trapezoidal Rule, and Simpson's Rule. (APC.16)

21. The student will find the derivatives of vector functions and parametrically defined functions and use them to solve problems. The problems will include tangent and normal lines to parametrically defined curves, velocity and acceleration, and velocity and acceleration vectors for motion on a plane curve. (APC.17)

22. The student will use integration to solve problems. (APC.18)

23. The student will write the locus definition of a circle, an ellipse, a parabola, and a hyperbola.

24. Given the appropriate information, the student will write the equation of a circle, an ellipse, a parabola, or a hyperbola.

25. The student will convert between polar and Cartesian coordinates.

26. The student will graph polar equations.