AP Calculus
Syllabus
2020-21
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Room E-13
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By successfully completing this course, you will be able to:

- Work with functions represented in a variety of ways and understand the connections among these representations.
- Understand the meaning of the derivative in terms of a rate of change and local linear approximation, and use derivatives to solve a variety of problems.
- Understand the relationship between the derivative and the definite integral.
- Communicate mathematics both orally and in well-written sentences to explain solutions to problems.
- Model a written description of a physical situation with a function, a differential equation, or an integral.
- Use technology to help solve problems, experiment, interpret results, and verify conclusions.
- Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.
- Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.

Technology Requirement
Graphing calculators are required. Texas Instrument 84 Plus is the one I use.

Course Outline
Unit 1: Limits and Continuity

A. Rates of Change
    1. Average Speed
    2. Instantaneous Speed
B. Limits at a Point
    1. 1-sided Limits
    2. 2-sided Limits
    3. Sandwich Theorem
C. Limits involving infinity
    1. Asymptotic behavior (horizontal and vertical)
    2. End behavior models
    3. Properties of limits (algebraic analysis)
    4. Visualizing limits (graphic analysis)

D. Continuity
    1. Continuity at a point
    2. Continuous functions
    3. Discontinuous functions
        a. Removable discontinuity (0/0 form)
        b. Jump discontinuity (We look at the greatest integer function)
        c. Infinite discontinuity

E. Rates of Change and Tangent Lines
    1. Average rate of change
    2. Tangent line to a curve
    3. Slope of a curve (algebraically and graphically)
    4. Normal line to a curve (algebraically and graphically)
    5. Instantaneous rate of change

Unit 2: The Derivative

A. Derivative of a Function
    1. Definition of the derivative (difference quotient)
    2. Derivative at a Point
    3. Relationships between the graphs and f and f'
    4. Graphing a derivative from data
    5. One-sided derivatives
B. Differentiability
    1. Cases where f'(x) might fail to exist
    2. Local linearity
    3. Derivatives on the calculator (Numerical derivatives using NDERIV)
    4. Symmetric difference quotient
    5. Relationship between differentiability and continuity
    6. Intermediate Value Theorem for Derivatives
C. Rules for Differentiation
    1. Constant, Power, Sum, Difference, Product, Quotient Rules
    2. Higher order derivatives
D. Applications of the Derivative
    1. Position, velocity, and acceleration
    2. Particles motion
E. Derivatives of trigonometric functions
F. Chain Rule
G. Implicit Differentiation
    1. Differential method
    2. y' method
H. Derivatives of inverse trigonometric functions
I. Derivatives of Exponential and Logarithmic Functions

Unit 3: Applications of the Derivative

A. Extreme values
    1. Relative Extrema
    2. Absolute Extrema
    3. Extreme Value Theorem
    4. Definition of a critical point

B. Implications of the Derivative
    1. Rolle's Theorem
    2. Mean Value Theorem
    3. Increasing and decreasing functions
C. Connecting f' and f'' with the graph of f(x)
    1. First derivative test for relative max/min
    2. Second derivative
        a. Concavity
        b. Inflection points
        c. Second derivative test for relative max/min
D. Optimization problems
E. Linearization models
    1. Local linearization
    2. Tangent line approximation
    3. Differentials
F. Related Rates

Unit 4: The Definite Integral

A. Approximating areas
    1. Riemann sums
        a. Left sums
        b. Right sums
        c. Midpoint sums
        d. Trapezoidal sums
    2. Definite integrals
B. Properties of Definite Integrals
    1. Power rule
    2. Mean value theorem for definite integrals
C. The Fundamental Theorem of Calculus
    1. Part 1
    2. Part 2

Unit 5: Differential Equations and Mathematical Modeling

A. Slope Fields
B. Anti-derivatives
    1. Indefinite integrals
    2. Power formulas
    3. Trigonometric formulas
    4. Exponential and Logarithmic formulas
C. Separable Differential Equations
    a. Growth and decay
    b. Slope fields
    c. General differential equations
    d. Newton's law of cooling
D. Logistic Growth

Unit 6: Applications of Definite Integrals

A. Integral as net change
    a. Calculating distance traveled (particle motion)
    b. Consumption over time
    c. Net change from data

B. Area between curves
    1. Area between a curve and an axis
        i. Integrating with respect to x
        ii. Integrating with respect to y
    2. Area between intersecting curves
        a. Integrating with respect to x
        b. Integrating with respect to y

C. Calculating volume
    1. Cross sections
    2. Disc method
    3. Shell method

Unit 7: Review/Test Preparation

A. Multiple-choice practice (Items from past exams-1997, 1998, and 2003 are used as well as items from review books)
    1. Test taking strategies are emphasized
    2. Individual and group practice are used

B. Free-response practice (Released items from the AP Central website are used.)
    1. Rubrics are reviewed so students see the need for complete answers
    2. Students collaborate to formulate team responses
    3. Individually written responses are crafted. Attention to full explanations is emphasized

Grading

- HW/Daily work 15%
- Quizzes 25%
- Tests 40%
- Benchmark 20%

Novel:

AP Calculus students will be reading exerts from *The Calculus Diaries* by Jennifer Ouellette.

Materials:

Each student needs to have each of the following items:

- Pencils
- Notebook Paper
- 2-3" three ring binder

Textbook:

Calculus, Sixth Edition
Larson, Hostetler and Edwards
Text book cost: $91.74. **If the textbook is stolen lost or damaged the student is responsible for the cost of the book.**

Classroom Rules:

- Be seated when the tardy bell rings. Tardiness=Detention!
- Be prepared for class.
- Be respectful.
- Follow directions.
- Do NOT disrupt class.

Notes

- You will be expected to take notes when going over new material. Please have pencil and paper available for each class.

Make-up Work

- Make-up work should be obtained upon returning from school. This is **your responsibility**. You have five days to complete make-up work from the day you return to school. Failure to complete make-up work will result in a "0" in the grade book.