Advanced Placement Calculus (AB)
Course Syllabus – Spring 2010
Mr. Meyer
Prerequisites: B/89 in Pre-calculus and/or approval of Department Chair
Text: Calculus, Early Transcendental Functions, Fourth Edition, Ron Larsen, Robert P. Hostetler, and Bruce H. Edwards, Boston: Houghton Mifflin Company, 2007.

Course Overview

Students are taught with the primary goal of understanding calculus concepts. This is done first by using concrete models whenever feasible, especially when introducing topics such as related rates, volumes of revolution, and volumes having known cross sections. Visual representation of concepts is the second step, especially by extensive use of the graphing calculator, an integral part of the course. It is used in class daily, primarily to graph functions, find zeros and intercepts of functions, evaluate derivatives at a specific point, and evaluate definite integrals. Each student is required to have his own graphing calculator (TI-83 or TI-84). Calculator Labs learned at workshops, from other teachers, and from several published resources, are integrated into each unit. This calculator effort is used to help students develop an intuitive feel for concepts before they are approached analytically, the third step in the learning process.

It is expected that every student will be successful on the AP Calculus AB Exam in May. Throughout the year, homework problems, class activities, and tests include questions from old AP examinations. The mid-course examination is made up entirely of test items from old AP tests or items written in AP format. The last two weeks of the course is devoted to students working on old AP exams, and finally a practice exam.

Rule of Four

From the beginning, students are taught using the "rule of four", and are assigned problems presented graphically, numerically, analytically, and verbally. I frequently supplement the primary textbook, which emphasizes analytical methods, with problems requiring students to produce solutions using numerical methods and tabular data, graphical interpretations of various graphs, and well-written, verbal justification of solutions in complete sentences, to give them the opportunity to communicate their reasoning process in words, using proper math terminology and notation. Additionally, the connections between these representations is emphasized. The key objective is for students to be able to explain their answers by showing their work and justifying their responses in writing on selected homework, quizzes and tests. The written justification is expected to be a clear explanation of their solutions in well-written, complete sentences, being specific, avoiding the use of pronouns, and without any calculator notation. These practices are in consonance with articles published on AP Central that provide examples of acceptable wording.

Materials:

Students are required to bring to each class the textbook, pencils, paper, a 3-ring loose-leaf binder notebook divided into four sections for notes, homework, handout problems from past A.P. exams, test corrections, and a graphing calculator. The TI-83/84 calculators are preferred. Students with other graphing calculators must become familiar with the instruction manual. Calculators may not contain games. Students who play games on their calculators during class time will have their calculators turned over to the Math Department Chair who will return the calculator after a conference with the

student and/or his/her parent.

Assignments:

Homework will be assigned daily, and most often collected the next day. Assignments submitted later than scheduled will not be accepted and a grade of zero will result. Each problem should be completed with all steps clearly shown.

Evaluation:

Tests routinely will be given throughout each quarter. Homework and quizzes will account for 30% of the weekly grade. Tests will account for the remaining 70%. Weekly grades are cumulative and will account for 80% of each quarter grade with the cumulative mid-term/final exam accounting for the remaining 20%. The average of both quarters' grades will determine the final course grade.

Make-up Work: For absences of fewer than three academic days – All homework due during the period of absence will be submitted upon return to class. Missed tests and quizzes will generally be made up after school on the designated make up day. **For longer, unplanned absences –** Students will submit a written timetable for the makeup of missed work. Failure to meet the timetable will result in a grade of zero being assigned for that particular piece of homework, quiz, or test. **For extended planned absences –** Students are responsible for determining, completing, and submitting all assignments due during the absence **prior to their departure unless other arrangements have been made with me.**

PCHS Honor Code:

Students will adhere to the Honor Code. Students may work cooperatively on homework problems. This includes giving and receiving explanations of problems and concepts, helping each other to spot mistakes, and comparing answers and methodologies. It does not include mindless copying or dictating solutions.

Advice for Being Successful:

1. Take notes; use them in doing homework;
2. Be prepared for class; do the homework assigned; identify difficulties.
3. Ask questions in class; expect to be questioned yourself.
4. Always use proper math symbols, vocabulary, and terminology.
5. Seek special help from me promptly if total dismay occurs.
6. Get notes from another student if an unforeseen absence occurs.
7. Notify me well ahead of time for planned absences.

8. Expect to be engaged in the learning process; a high level of intellectual curiosity is expected and encouraged.

9. Stay on schedule!

Course Outline:

Unit 1 – Limits and Their Properties

- An introduction to limits: an intuitive understanding of the limit process
- Using graphs and tables of data to determine limits
- Properties of limits
- Algebraic techniques for evaluating limits
- Continuity and one-sided limits
- Geometric understanding of the graphs of continuous functions
- Intermediate Value Theorem

- Infinite limits
- Using limits to find the asymptotes of a function

Unit 2 – Differentiation

- Zooming-in activity and local linearity
- Understanding the derivative: graphically, numerically and analytically
- The derivative, tangent lines, and slope
- Approximating rates of change from graphs and tables of data
- The derivative as the limit of the average rate of change, an instantaneous rate of change, the limit of the difference quotient, and the slope of a curve at a point
- The meaning of the derivative-translating verbal descriptions into equations and vice-versa
- The relationship between differentiability and continuity
- Functions that have a vertical tangent at a point
- Functions that have a point on which there is no tangent
- Basic differentiation rules (power, product, and quotient rules) and rates of change, for basic functions including power functions, natural exponential functions and trigonometric functions
- Instantaneous and average rates of change
- Position functions, velocity, and acceleration
- Higher order derivatives
- The chain rule
- The natural logarithmic function and differentiation
- Differentiation of exponential functions and logarithmic functions having bases other than e
- Implicit differentiation
- Derivatives of inverse functions
- Derivatives of inverse trigonometric functions
- Related rates problems
- Graph relationships for f, f', and f''

Unit 3 – Applications of Differentiation

- Extrema on an interval and the Extreme Value Theorem; this includes justifying points of relative extrema using proper mathematical terms as published on AP Central, and doing so in well-written complete sentences.
- Rolle's Theorem and the Mean Value Theorem, and their geometric consequences, that must be communicated by students on assessments in complete well-written sentences.
- Increasing and decreasing functions and the First Derivative Test
- Concavity and its relationship to the first and second derivatives
- Second Derivative Test
- Limits at infinity
- Horizontal and slant asymptotes
- A summary of curve sketching-using geometric and analytic information as well as calculus to predict the behavior of a function
- More relating the graphs of f, f', and f''

- Optimization (Max/Min) problems including both relative and absolute extrema
- Tangent line to a curve, differentials, and linear approximations
- Application problems including position, velocity, acceleration, and rectilinear motion

Unit 4 – Integration

- Anti-derivatives and indefinite integration of power functions, trigonometric functions, natural exponential functions, and exponential functions having bases other than e
- Anti-derivatives resulting in particular solutions by using initial conditions
- Basic properties of the definite integral
- Area under a curve and area of a region
- Meaning of the definite integral, that must be communicated by students on assessments in complete well-written sentences
- Definite Integral as a limit of Riemann sums
- Riemann sums, including left, right, and midpoint sums
- Trapezoidal sums, and the Trapezoidal Rule
- Use of Riemann sums and trapezoidal sums to approximate definite integrals of functions that are represented graphically and analytically
- Use of the Fundamental Theorem to evaluate definite integrals
- The Mean Value Theorem for Integrals and the average value of a function
- Second Fundamental Theorem of Calculus
- Integration by substitution including the natural exponential function
- The natural logarithmic function: integration
- Inverse trigonometric functions: integration

Unit 6 – Differential Equations

- Use of slope fields to interpret a differential equation geometrically
- Drawing slope fields and solution curves for differential equations
- Using separation of variables to solve differential equations
- Applications of differential equations in exponential growth and decay problems

Unit 6 – Applications of Integration

- The integral as an accumulator of rates of change, which must be communicated by students on assessments in complete well-written sentences
- Area of a region between two curves
- Volume of solids of revolution
- Volume of a solid with known cross sections

Classroom rules:

1. **Come to class prepared.**
2. **Be in your seat with notebook open when the tardy bell rings.**
3. **Show respect** to me and to your classmates by **not talking** when I am teaching or another student is responding. If you wish to speak, raise your hand (you will be recognized) before speaking.
4. **Use "Please", "Thank You", "Excuse Me", "Pardon", etc.**
5. **Have a Winning Attitude! Let's have success!**