2013 ~ 2014 AP CALCULUS AB SYLLABUS

Teacher: Mr. Leckie
Room 508
Course: AP Calculus AB
Textbook: *Calculus: Graphical, Numerical, Algebraic, 3rd edition*

***COURSE CONTENT*:** Calculus is the mathematics of change – velocities and accelerations. Calculus is also the mathematics of tangent lines, slopes, areas, volumes, arc lengths, centroids, curvatures, and a variety of other concepts that have enabled scientists, engineers, and economists to model real – life situations. Although precalculus mathematics also deals with velocities, accelerations, tangent lines, slopes, and so on, there is a fundamental difference between precalculus mathematics and calculus. Precalculus mathematics is static, whereas calculus is more dynamic. The idea that separates calculus from precalculus mathematics is the limit process. You may or may not have already studied some limit properties. We will begin with those ideas and build upon them to lead us to a new calculus formulation, such as derivatives and integrals.

Every student taking AP Calculus is expected to take the Advanced Placement exam in May.

1st Semester (1 block = 90 min)
Schedule is tentative due to Snow/Late Start Days, Testing (CSAP, ACT, SCANTRON), extra practice needed, etc.

Chapter 1: Prerequisites for Calculus (9 blocks)

1.1 Lines (1 block)
1.2 Functions and Graphs (1 block)
1.3 Exponential Functions (1 block)
Extension: Parent Functions and Their Graphs (1 block)
Extension: Conics (1 block)
1.5 Functions and Logarithms (1 block)
1.6 Trigonometric Functions (1 block)
REVIEW (1 blocks)
TEST Chapter 1 (1 block)

Chapter 2: Limits and Continuity (8 blocks)

2.1 Rates of Change and Limits (2 blocks)
- Graphically
- Analytically
- Numerically

2.2 Limits Involving Infinity (1 block)
- Graphically
- Analytically
- Numerically
- How it relates to asymptotic behavior
- How to evaluate by comparing relative magnitudes of functions

2.3 Continuity (1 block)
- Intermediate Value Theorem
- Extreme Value Theorem
- Using the limit definition of continuity to show functions (usually piecewise) are continuous

2.4 Rates of Change and Tangent Lines (1 block)
- Instantaneous Rate of Change vs. Average Rate of Change

REVIEW (2 blocks)
TEST Chapter 2 (1 block)

Chapter 3: Derivatives (13 blocks)

3.1 Derivative of a Function (1 block)
- Graphically
- Analytically
- Numerically – See Worksheet (Instantaneous Rate of Change)
- Introduction to Slope Fields

3.2 Differentiability (1 block)
- Graphically
- Analytically
- Numerically

3.3 Rules for Differentiation (2 blocks)

3.4 Velocity and Other Rates of Change (1 block)
- Graphically
- Analytically

3.5 Derivatives of Trigonometric Functions (1 block)
REVIEW (2 blocks)
TEST Chapter 3.1 – 3.5

3.6 Chain Rule (1 block)
3.7 Implicit Differentiation (1 block)
3.8 Derivatives of Inverse Trigonometric Functions (1 block)
3.9 Derivatives of Exponential and Logarithmic Functions (1 block)

Chapter 4: Extreme Values of Functions (10 blocks)

4.1 Extreme Values of Functions (1 block)
- Absolute vs. Relative

4.2 Mean Value Theorem (1 block)
- Graphically
- Analytically
- Numerically

4.3 Connecting f' and f'' with the Graph of f (1 ½ blocks)
- Using graph of f' to determine properties of f

4.4 Modeling and Optimization (1/2 block)
REVIEW (2 blocks)
TEST Chapter 3.6 – 4.4 (1 block)

REVIEW FOR FINAL EXAM (2 blocks)
1st SEMESTER FINAL EXAM (1 block)

<u>2nd Semester</u>

4.5 Linearization and Newton's Method (1 block)
4.6 Related Rates (2 blocks)

Chapter 5: The Definite Integral (8 blocks)

5.1 Estimating with Finite Sums (1/2 block)
- Riemann Sums
- Left, Right, and Midpoint approximations
  - Graphically
  - Numerically

5.5 Trapezoidal Rule (1/2 block)
5.2 Definite Integrals (1 block)
- Basic Properties

5.3 Definite Integrals and Antiderivatives (1 block)
- Average Value of a Function

5.4 Fundamental Theorem of Calculus (2 blocks)
- Used to Evaluate Definite Integrals
- Used in the definition of function
  - Graphically
  - Analytically
  - Numerically

REVIEW (2 blocks)
TEST Chapter 4.5 – 5.5 (1 block)

Chapter 6: Differential Equations and Mathematical Modeling (7 blocks)

6.1 Antiderivatives and Slope Fields (1 block)
- Solving differential equations using initial conditions

6.2 Integration by Substitution (2 blocks)
6.4 Exponential Growth and Decay (1 block)
- Using differential equations in context
- Separate and Integrate

REVIEW (2 blocks)
TEST Chapter 6 (1 block)

Chapter 7: Applications of Definite Integrals (10 blocks)

7.1 Integral as Net Change (1 block)
- Displacement vs Distance Traveled
- Integral of a Rate of Change gives accumulated change.

7.2 Areas in the Plane (1 block)

7.3 Volumes (4 blocks)
- Solids with known cross sections
- Solids of revolution
  - Disc Method
  - Washer Method
  - Shell Method

REVIEW (3 blocks)

TEST Chapter 7 (1 block)

Chapter 8: L'Hopital's Rule, Improper Integrals, and Partial Fractions (2 blocks)

8.1 L'Hopital's Rule (1 block)

8.2 Relative Rates of Growth (1 block)

REVIEW FOR AP EXAM (Every waking moment you have ☺)

AP EXAM … TBA … Usually first full week of May

2nd SEMESTER FINAL EXAM … TBD

TEACHING STRATEGIES

Contextual situations are used to apply many of these concepts, including, but not limited to, position, velocity, and acceleration, average value, related rates, optimization, and volumes of solids (known perpendicular cross sections and rotated). Students often work in groups when investigating a new topic graphically or numerically and when working on problems given during class.

The "Rule of 4" (graphical, numerical, analytical, and verbal) is used as a broad outline for the course. The textbook supports graphical, numerical, and algebraic exploration and problem solving. Students are also required to correctly use mathematical syntax both in written and oral form in explaining their solutions. The ability to correctly speak the language of mathematics is valued. This is done both in class and on exams through correctly written solutions.

TECHNOLOGY AND COMPUTER SOFTWARE

As the name of the textbook implies, students are asked to explore many of the concepts in this course graphically, analytically, and numerically. When appropriate, the use of a graphing calculator is used to explore, to solve, or to confirm the student's work. All students are required to have a graphing calculator (most use a TI-83+ or the TI-84+). Demonstration and instruction on the use of the calculator is done using a TI-83+ on either a TI-Presenter through the TV or on a SmartBoard.

Students are expected to be able to graph a function within a given window, find the zeros of functions and where two functions intersect, calculate the derivative at a point, and calculate a definite integral. We also spend time discussing when the calculator cannot be relied upon for accurate information, including asymptotic behavior and finding derivatives of certain functions, like $|x|$ at $x = 0$. Other functions of the calculator are taught in order to use the calculator more efficiently, including, but not limited to, using tables to help with the numerical exploration of concepts, storing calculated values for future use, and using the "*y*-vars" values. Emphasis is put on using the correct mathematical notation and vocabulary in order to use the calculator to justify their responses.

Autograph software, the TI-NSPIRE, and various websites are used to demonstrate or explore concepts that use graphs of implicitly defined functions, volumes of solids of revolution, and volumes of solids with known cross sections, just to name a few.

STUDENT EVALUATION

Both formative and summative evaluations are used during this course. Quizzes will generally be given in class (about every 2 class periods is the goal), but occasionally may be given as a take-home assignment.

Grading: Your 18 – week grade will be weighted with the following percentages:
- Homework: 10%
- Quizzes: 15%
- Tests: 75%

Final:
- The Final exam will be cumulative and worth 25% of your semester grade.

SCALE: Grades will be posted as often as possible. You should be checking Infinite Campus OFTEN!
- 84.50 – 100.00% A
- 69.50 – 84.49% B
- 54.50 – 69.49% C
- 49.50 – 54.49% D

Assignments:
- Assignments may included Videos (vodcasts), Worksheets, and/or book work.
- The vodcasts will be posted on my website. If you can stream YouTube, you can watch the videos. Please see me if there are any issues with internet access or computer access as soon as possible!
- Each vodcast has a section of notes. The notes MUST be completed for each vodcast prior to coming to class.
- Assignments will be corrected based on completeness only, but it is only beneficial if you make sure it is correct.
- The ABSOLUTE LAST day for late homework is the week before final exams (date TBD)

Quizzes:
- There will be two types of quizzes given in class:
    - The first type will be focused on specific skills.
        - These will usually be given every two class periods.
        - You must score 70% or higher or retake the quiz BEFORE the chapter exam.
        - Many times these quizzes will be given in groups
            - Group quizzes are only for those who are in attendance the day the quiz is given
            - If you are not present on the day of the quiz, you will be given a 0 and must take the retake.
    - The second type will be more like and AP exam question.
        - These quizzes may NOT be retaken and will be scored out of 9 points
        - The more you explain your response using correct mathematical notation and vocabulary, the better chance you have of earning full credit.
        - This will typically be given as a take home assignment, and you are expected to do your own work.
        - Quizzes not turned in on time will be docked 2 points the first day and will not be accepted more than one class period late.

Tests:
- Tests will usually be given after the completion of each chapter. However, longer chapters (like chapter 3) may be broken into smaller sections.
- Each test will consist of free-response and multiple-choice questions for each chapter and could include review questions from previous chapters. Tests will be given in two parts (with and without a calculator).
- Each chapter (or partial chapter) test will be weighted the same.
- All electronic devices besides your calculator are NOT ALLOWED during exams.
- There are NO retakes of exams.

***CLASSROOM EXPECTATIONS*:**
#1: You are expected to be ON TIME. There are no bells, but the clocks are set to the exact time. Be here early, so you are ready to start at the right time.
#2: You are expected to treat EVERYONE in the class with the same attitude of respect you expect to treated. This includes the language you use, the attitude you bring to class, and the way you respond when asked to do something in class.

Consequences: Failure to follow the rules and procedures will result in any of the following:
1. Warning … Student – Teacher conference … in the case of tardies, you will receive 3 warnings.
2. Parent phone call and/or Academy Detention
3. Referral to an Administrator

***ABSENCES*:**
- All assignments are online. Homework is typically a video and to finish any worksheets from class.
- Any vodcasts (and the notes that go with them) that you missed should be watched ***prior*** to your return.
- It is ***YOUR*** responsibility to find out what you missed!!!!!!!!!

SUPPLIES: The following is a list of supplies (other than your ***book***) that will be needed throughout the course of the year. For some in-class activities, there is a limited number of supplies in the classroom. However, you will need to use most of these supplies at home. It is in your best interest to obtain as many of them as possible.
- A 3-ring notebook dedicated to this class (a 1" binder should be enough to hold everything)
- An approved graphing calculator that has the ability to perform the skills listed previously under the "Technology and Computer Software" section … We will use a TI-83+ or a TI-84+ in class.
- Notecards (spiral bound) … 3x5 or 4x6 are fine … these will be turned in on the day of every exam.
- Pencils (I will not be providing pencils at any time)
- ID CARD --- used to check out any supplies that we might use in class.

***RESOURCES AVAILABLE*:**
Mr. Leckie's website: http://www.chaoticgolf.com

Review Sheets with Solutions
Class Lecture Notes, Vodcasts, and Worksheets
Notecards (not all are complete)
Graph paper available to be printed

Syllabus may be read online
Contact Mr. Leckie through an email form
Limited links to other Math sites on the Internet

Academy/Interventions … Available Times: _____

One day a week has been designated for math interventions. That day is _____. You may attend voluntarily whenever you feel like you need help. You may also be required to attend for various reasons …
1. Not turning in all your homework,
2. Falling behind in work due to absences or other reasons,
3. Having a D or F,
4. Earning less than a 70% on any quiz.

Failure to show when required may result in an academy detention, referral to assistant principal, or loss of privileges (off campus, partials, extracurricular or athletic activities).

DUAL CREDIT OPTION:

It is possible to receive dual credit for this course at UCCS through the "CU Succeed" Program. You will enroll in Math 135 at UCCS for their second semester and receive 1 semester of college math credit on a UCCS transcript. The grade you receive on the UCCS transcript will be a cumulative total of your first and second semester grades for PreCalculus.
You DO NOT have to attend UCCS in the future to receive credit as long as the college you attend accepts transfer credits from UCCS.

There is NOTHING extra you must do to earn the dual credit other than complete the required paperwork and pay the fees.

The cost will be determined by UCCS but was approximately $205 last year for a 4-unit course. Details and more information will be passed out in class later in the year (sometime between October and January ... it seems to change each year, but I will let you know as soon as UCCS lets me know).

**Taking the Dual Credit Option requires you to complete a second semester final exam.

The following is the AP Calculus AB Course Description as given by the College Board.
All of these topics are covered in the Course Outline. … before the AP exam, it's a good study list.

I. Functions, Graphs, and Limits

Analysis of graphs
With the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.

Limits of functions (including one-sided limits)
- An intuitive understanding of the limiting process
- Calculating limits using algebra
- Estimating limits from graphs or tables of data

Asymptotic and unbounded behavior
- Understanding asymptotes in terms of graphical behavior
- Describing asymptotic behavior in terms of limits involving infinity
- Comparing relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth)

Continuity as a property of functions
- An intuitive understanding of continuity (The function values can be made as close as desired by taking sufficiently close values of the domain.)
- Understanding continuity in terms of limits
- Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem)

II. Derivatives

Concept of the derivative
- Derivative presented graphically, numerically, and analytically
- Derivative interpreted as an instantaneous rate of change
- Derivative defined as the limit of the difference quotient
- Relationship between differentiability and continuity

Derivative at a point
- Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.
- Tangent line to a curve at a point and local linear approximation
- Instantaneous rate of change as the limit of average rate of change
- Approximate rate of change from graphs and tables of values

Derivative as a function
- Corresponding characteristics of graphs of f and f'
- Relationship between the increasing and decreasing behavior of f and the sign of f'
- The Mean Value Theorem and its geometric consequences
- Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa

Second derivatives
- Corresponding characteristics of the graphs of f, f', and f''
- Relationship between the concavity of f and the sign of f''
- Points of inflection as places where concavity changes

Applications of derivatives

- Analysis of curves, including the notions of monotonicity and concavity
- Optimization, both absolute (global) and relative (local) extrema
- Modeling rates of change, including related rates problems
- Use of implicit differentiation to find the derivative of an inverse function
- Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
- Geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations

Computation of derivatives

- Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric
- Basic rules for the derivative of sums, products, and quotients of functions
- Chain rule and implicit differentiation

III. Integrals

Interpretations and properties of definite integrals

- Definite integral as a limit of Riemann sums
- Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:

$$\int_a^b f'(x)\,dx = f(b) - f(a)$$

- Basic properties of definite integrals (examples include additivity and linearity)

Applications of integrals

Appropriate integrals are used in a variety of applications to model physical, biological, or economic situations. Although only a sampling of applications can be included in any specific course, students should be able to adapt their knowledge and techniques to solve other similar application problems. Whatever applications are chosen, the emphasis is on using the method of setting up an approximating Riemann sum and representing its limit as a definite integral. To provide a common foundation, specific applications should include using the integral of a rate of change to give accumulated change, finding the area of a region, the volume of a solid with known cross sections, the average value of a function, and the distance traveled by a particle along a line.

Fundamental Theorem of Calculus

- Use of the Fundamental Theorem to evaluate definite integrals
- Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined

Techniques of antidifferentiation

- Antiderivatives following directly from derivatives of basic functions
- Anitderivatives by substitution of variables (including change of limits for definite integrals)

Applications of antidifferentiation

- Finding specific antiderivatives using initial conditions, including applications to motion along a line
- Solving separable differential equations and using them in modeling (in particular, studying the equation $y' = ky$ and exponential growth)

Numerical approximations to definite integrals

Use of Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values