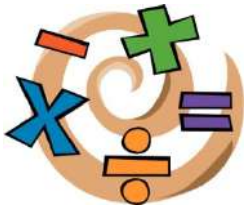

AP Calculus AB Syllabus
Calculus and Analytic Geometry

Course Overview and Philosophy

Students electing to take this course have the option to chose if they will sign up to receive six credits of mathematics credits in Calculus from our local community college or to take the Calculus AB Advanced Placement test. Because of the options associated with the course, my main objective is to supply students with a solid foundation of curriculum based on college level requirements and expectations. Students in this course are expected to put forth efforts as deemed necessary to perform well at the collegiate level. Because of the rigorous material, each year my students have the opportunity to rise to the challenge and take away an exceptional portfolio of mathematical and critical thinking skills.

Primary Textbook

Larson, Hostetler, Edwards. *Calculus*. 8th ed. New York: Houghton Mifflin Company, 2006.

Course Outline

Chapter 1 – Limits and Their Properties

1. Estimating limits graphically and numerically
2. Evaluating Limits Analytically
3. Continuity and one-sided limits
4. Infinite limits

Examples of class discussion questions:

- Is it more costly to remove the first 90% or last 10% of pollutants being released into the air by a plastics company?
- Compare and contrast problems able to be solved with Algebra verses Calculus.

Examples of in class activities:

- Use a graphing calculator to explore the relationship between limits analytically, graphically, and numerically.

Chapter 2 – Differentiation

1. The tangent line problem

2. Basic differentiation rules and rates of change

3. Product and quotient rules and higher-order derivatives

4. The chain rule

5. Implicit differentiation

6. Related rates

Examples of class discussion questions:

- When pumping air into a balloon until it bursts, will the diameter of the balloon change more rapidly when you begin pumping or right before it bursts?
- How does the tangent line relate to the derivative?
- In what types of real life situations would we be concerned with the rate at which something changes?

Examples of in class activities:

- Graphically develop the tangent line problem.
- Discover the power rule using the limit definition on various functions.
- Use the graphing calculator to verify derivatives of functions found by hand.
- Given a function, plot the values of its derivative to see the new function develop.

Chapter 3 – Applications of Differentiation

1. Extrema on an interval

2. Rolle's Theorem and Mean Value Theorem

3. Increasing and decreasing functions and the First Derivative Test

4. Concavity and the Second Derivative Test

5. Limits at infinity

6. Curve sketching

7. Optimization problems

8. Newton's Method

9. Differentials

Examples of class discussion questions:

- When molten glass is being formed in the flame and then removed to air temperature, will the glass ever reach room temperature?

Examples of in class activities:
- Graphically develop Rolle's Theorem and the Mean Value Theorem.
- Sketch a curve using analytic methods developed in this chapter and verify on graphing calculator.
- Complete a critical thinking assignment on optimization.
- Complete a writing assignment discussing any ambiguities of an optimization problem.
- Jeopardy game that encourages verbalizing curve sketching techniques.

Chapter 4 – Integration

1. Antiderivatives and indefinite integration
2. Area under a curve
3. Reimann sums and definite integrals
4. The Fundamental Theorem of Calculus
5. Integration by substitution
6. Numerical integration

Examples of class discussion questions:
- Is a jet's velocity constant or changing when it breaks the sound barrier?

Examples of in class activities:
- Discover the representation of antiderivatives given a variety of derivatives and describing the original functions.
- Integrate a function by hand and verify the results on a graphing calculator.

Chapter 5 – Logarithmic, Exponential, and Other Transcendental Functions

1. The natural logarithmic function: differentiation
2. The natural logarithmic function: integration
3. Inverse functions
4. Exponential functions: differentiation and integration
5. Bases other than *e* and applications
6. Inverse trigonometric functions: differentiation

7. Inverse trigonometric functions: integration

8. Growth and decay

Examples of class discussion questions:

- When an underground hot spring produces steam and forces water up through the earth, do you think an increase or a decrease in pressure causes water to boil at a lower temperature?

Examples of in class activities:

- Graph `y1=1x` and `y2=ddxlnx` and explain why graphs seem similar.
- Given various functions, explain how to "undo" them, and graph the pairs to see the relationships.

Chapter 7 – Applications of Integration

1. Area of a region between two curves

2. Volume: The Disk Method

3. Volume: The Shell Method

4. Arc length and surfaces of revolution

Examples of class discussion questions:

- How would you find the volume of the Epcot ball that houses the Spaceship Earth ride?

Examples of in class activities:

- Visualization activity to help students develop a solid of revolution in their minds.
- Critical thinking activity involving solids of revolution.

Teaching Strategies and Activities

At the beginning of each chapter, students are asked to read a short excerpt of a real life situation containing a mathematical application and/or problem having to do with the material in the coming weeks and discuss their opinions with a small group. Each group presents their ideas to the class. Refer to the shortened discussion questions given above for examples.

A "homework" day is devoted to answering questions and explaining ideas after each section of material in the chapter. Students volunteer to put work on the boards and explain the steps used and why to their classmates.

Before assessments, students are given the opportunity to work in class collaborating on additional problems being evaluated. They are encouraged to work together on homework and specific take home assignments.

At the end of each chapter, students are given a list of short response questions in which they must answer in complete sentences. An example of a short response question would be “explain the process of optimization” or “describe the relationship between the graphs of a function and its first derivative.” Students are expected to be prepared to supply their answers on chapter assessments.

Calculators are an integral part of each lesson and homework assignments and required for certain assessments. All students have their own TI-89 Titanium and are expected to bring them to class each day. Various discovery elements of the lectures involve making predictions based on data from the graphing calculators. We also discuss technology pitfalls and basic applications the calculators can perform such as derivatives and integration.