Curriculum Map for:

Prepared October 11, 2005

Prerequisites: Before studying calculus, all students should complete four years of high school mathematics designed for college-bound students: courses in which they study algebra, geometry, trigonometry, analytic geometry, and elementary functions. These functions include those that are linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and piecewise defined. In particular, before studying calculus, students must be familiar with the properties of functions, the algebra of functions, and the graphs of functions. Students must also understand the language of functions (domain and range, odd and even, periodic, symmetry, zeros, intercepts, and so on) and know the values of the trigonometric functions at common angles and angles co-terminal with the common angles.

Scope: AP Calculus AB consists of a full high school academic year of work that is comparable to calculus courses in colleges and universities. It is expected that students who take AP Calculus AB will seek college credit, college placement, or both from institutions of higher learning. Success in AP Calculus AB is closely linked to the preparation students have had in courses leading up to this course. Students should have demonstrated mastery of prior material. AP Calculus AB is primarily concerned with developing the students' understanding of the concepts of calculus and providing exposure to its methods and applications. The course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally.

Assessment:

Assessment comes in a variety of forms and wherever possible should be used to reflect and enhance the teaching and learning process that occurs in a classroom. Assessment should not be seen as a separate activity, but as an integral part of the teaching and learning process. Alternative assessments apply to any and all assessments that differ from multiple choice, timed, one-shot approaches that characterize most standardized and classroom assessment. Authentic assessments are assessments that engage students in applying knowledge and skills in the same way they are used in the real-world. Performance assessment is a broad term, encompassing many of the characteristics of both authentic and alternative assessments.

All assessments in AP Calculus AB are modeled after the AP exam. Sections include multiple choice and free response. In the free response sections of assessments, students are expected to show their methods and explain their thought processes.

The **TIME** column offers a suggested time-line so that all topics listed in the **CONTENT/SKILLS** column are feasibly met. It is understood that times will need adjustments as the course develops. The **APPLICATION/PROJECT IDEAS** column offers suggestions and sources for the teacher. This column should be updated periodically to keep current and as new ideas are generated. The **KEY IDEA/PERFORMANCE INDICATOR** column coordinates topics with the NYS standards.

TIME	CONTENT/SKILLS	APPLICATIONS/PROJECT IDEAS	KEY IDEA/PERFORM INDICATOR
September (12 Days)	***Topics from Precalculus*** • Produce the graph of a function on a coordinate system with the aid of technology. • Identify the zeros of a function. • Explore local and global behavior of a function. • Analyze functions graphically, numerically, and analytically. • Analyze rational inequalities. • Use the circle equation and explore tangent lines to the circle. • Review trigonometric functions and values.	An intensive trigonometry review is helpful here. Students will benefit from a review packet focused on progressing them through trigonometric concepts like coterminal angles and analyzing graphs.	ALL TOPICS ARE FROM THE COLLEGE BOARD. NEW YORK STATE FOLLOWS THE COLLEGE BOARD CURRICULUM FOR THIS COURSE.
Sept.-Oct. (11 Days)	***Limits and Continuity*** • Calculate limits using algebra. • Estimate limits using graphs and tables of data. • Describe asymptotic and unbounded behavior in terms of limits. • Interpret continuity in terms of limits. • Understand and perform the Continuity Test.	It is helpful to give students an exploration activity with the calculator where students investigate the behavior of 10-12 functions. After the investigation, have them categorize the functions to form general rules about limits.	

TIME	CONTENT/SKILLS	APPLICATIONS/PROJECT IDEAS	KEY IDEA/PERFORM INDICATOR
October (18 Days)	***Differentiation*** • Define the derivative as the limit of the difference quotient. • Analyze derivatives graphically, numerically, and analytically. • Explain the relationship between differentiability and continuity. • Interpret the derivative as the instantaneous rate of change of a function. • Apply the Mean Value Theorem • Relate the tangent line to a curve and local linear approximation to the derivative. • Approximate the rate of change from graphs and tables of values. • Calculate first and second derivatives. • Verify and generate the graphs of functions using the graphs of f' and f''.	Starting derivatives with some basic review of average rate of change and slope is helpful.	
Nov.-Dec. (28 Days)	***Applications of Derivatives*** • Analyze curves using the notions of concavity. • Utilize differentiation rules for basic functions including exponential, logarithmic, trigonometric and inverse functions.	Spend 2-3 days specifically on sketching graphs from information gathered from the first and second derivatives. Students often struggle with this. Charts with characteristics are helpful.	

TIME	CONTENT/SKILLS	APPLICATIONS/PROJECT IDEAS	KEY IDEA/PERFORM INDICATOR
	• Apply basic differentiation rules for sums, products, quotients. • Utilize the chain rule and implicit differentiation. • Model rates of change and related rates in real-word problems. • Solve optimization problems examining both absolute and relative extrema. • Interpret the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration. • Model rates of change, including related rates problems. • Interpret differential equations geometrically via slope fields. • Describe the relationship between slope fields and solution curves for differential equations.		

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Dec. - Feb. (29 Days)	***Integration*** • Estimate the area under a curve using geometric formulas. • Compute Riemann sums using left, right, and midpoint evaluation points. • Define the definite integral as a limit of Riemann sums over equal subdivisions. • Identify the integral as the accumulator of the quantity of the rate of change function. • Use basic properties of integrals.		
Feb. - March (22 Days)	***Applications of Integration*** • Recognize that the techniques of antidifferentiation follow directly from derivatives of basic functions. • Determine antiderivatives by substitution of variables including change of limits for definite integrals. • Evaluate definite and indefinite integrals using integration by parts. • Investigate physical, social, and economic situations with appropriate integrals. • Determine the area and volumes of geometric figures using integrals. • Solve separable differential equations. • Find specific antiderivatives using initial conditions.	After being instructed on integration, send students to websites that demonstrate various techniques for finding volume. Have them critique the websites for clarity and content.	

TIME	CONTENT/SKILLS	APPLICATIONS/PROJECT IDEAS	KEY IDEA/PERFORM INDICATOR
April (20 Days)	• Use separable differential equations to study the equation y' = ky. • Find the volume of a solid with known cross sections. • Use the Average Value Theorem to approximate integrals. • Approximate definite integrals of functions represented algebraically, graphically, and by tables of values using the Trapezoid Rule, Simpson's Rule, and Riemann Sums. ***AP Exam preparation*** • Take and score various practice exams. • Review in detail appropriate notations for exam. • Emphasize written expression of ideas.	It is better to spend a few days only on multiple choice and a few days only on free response. Then, move towards entire practice exams. Have the students take one of the beginning exams in groups to build confidence.	

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May-June (20 Days)	***Various projects and activities*** • Group work on logic and problem sovling. • In depth analysis of AP Free response questions. • Independent projects. • History of Calculus.	Logic project involving Pirates is always a productive one. Have students reason out their answers and then spend time preparing how to present their justifications. Having students present the AP Free response questions is a good way to reinforce their skills at verbal communication of mathematics.	