Program of Studies Description

*40451H ADVANCED PLACEMENT CALCULUS AB

(Grade 11,12) (1.0 Credit)

(Prerequisite: Honors Trigonometry/Algebra 3 or Calculus, and teacher recommendation)

Advanced Placement Calculus AB is for the student wishing to gain credit for one semester of college calculus by taking the Calculus AP examination which is given in May. Students will learn how to differentiate, integrate, calculate limits, and determine the continuity of functions. They will apply these skills to in-depth theoretical and real-life problems. Individually or in small groups, students will use appropriate technology to analyze and solve problems involving limits, optimization, differentials, related rates, curve sketching, separable differential equations, exponential growth and decay, average value, area between 2 curves, volumes of solids of revolution, and volumes of solids with known cross-sections. Achievement will be demonstrated through the completion of in-depth rigorous tests, quizzes, and homework assignments, which prepare the student for the AP Exam. **Students will have the opportunity to register to take the AP Exam in May.**

Advanced Placement Calculus AB
Syllabus

DESCRIPTION OF COURSE:

Advanced Placement Calculus AB is for the student wishing to gain credit for one semester of college calculus by taking the Calculus AP examination which is given in May. Students will learn how to differentiate, integrate, calculate limits, and determine the continuity of functions. They will apply these skills to in-depth theoretical and real-life problems. Individually or in small groups, students will use appropriate technology to analyze and solve problems involving limits, optimization, differentials, related rates, curve sketching, separable differential equations, exponential growth and decay, average value, area between two curves, volumes of solids of revolution, and volumes of solids with known cross-sections. Achievement will be demonstrated through the completion of in-depth rigorous tests, quizzes, and homework assignments, which prepare the student for the AP exam. Students are responsible for completing a summer assignment for this course before the school year begins. **In order to receive AP weight for this class, students must take the AP Exam in May.** ** Eligible content taken from mathematical practices from College Board AP Calculus **

REQUIRED TOPICS OF STUDY	SUGGESTED INSTRUCTIONAL TIME	STANDARDS/ELIGIBLE CONTENT
Review of Trigonometric Topics and Tables	4 class periods	CC.2.2.HS.C.1, CC.2.2.HS.C.2, CC.2.2.HS.C.3, CC.2.2.HS.C.5, CC.2.2.HS.D.2
Unit 1: Limits and Continuity	10 class periods	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16
Unit 2: Differentiation: Definition and Basic Derivative Rules	10 class periods	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10
Unit 3: Differentiation: Composite, Implicit, and Inverse Functions	5 class periods	3.1, 3.2, 3.3, 3.4, 3.5, 3.6
Unit 4: Contextual Applications of Differentiation	6 class periods	4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7
Unit 5: Analytical Applications of Differentiation	10 class periods	5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12
Unit 6: Integration and Accumulation of Change	15 class periods	6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.14
Unit 7: Differential Equations	10 class periods	7.1, 7.2, 7.3, 7.4, 7.6, 7.7, 7.8

Unit 8: Applications of Integration	10 class periods	8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11, 8.12

RESOURCES: Calculus: Graphical, Numerical, Algebraic(3rd Edition). Pearson Prentice Hall, 2007
TI-84 Plus or TI-84 CE(color edition.)

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Curriculum Map

Unit 1	***Limits and Continuity***	
Big Idea	**Limits**	
Unit Essential Questions:	**How does knowing the value of a limit , or that a limit does not exist help you to make sense of interesting features of functions and their graphs**	
Total Number of Days for Unit	**10**	

Date/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr	Resources
	Calculate average and instantaneous speeds. Define and calculate limits for function values and apply the properties of limits. Use the Sandwich Theorem to find certain limits indirectly. Find and verify end behavior models for various functions.		Notes Worksheets, AP Classroom Delta Math IXL TI Graphing Calculator	Quizzes and Tests		

	Calculate limits as $x \to \pm\infty$ and to identify vertical and horizontal asymptotes. Identify the intervals upon which a given function is continuous and understand the meaning of continuous function. Remove removable discontinuities by extending or modifying a function. Apply the Intermediate Value Theorem and the properties of algebraic combinations and composites of continuous functions. Apply directly the definition of the slope of a curve in order to calculate slopes. Find the equations of the tangent line to a curve at a given point. Find the average rate of change of a function.					

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Curriculum Map

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Unit 2	**Differentiation: Definition and Fundamental Properties**
Big Idea	**Derivatives allow us to determine instantaneous rates of change. Develop the understanding of how the definition of the derivative applies limits to average rates of change, create opportunities for students to explore average rates of change of increasingly small intervals.**
Unit Essential Questions:	**Why do mathematical properties and rules for simplifying and evaluating limits apply to differentiation?**
Total Number of Days for Unit	**10**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Calculate slopes and derivatives using the definition of the derivative Graph *f* from the graph of *f'*, graph *f'* from the graph of *f*, and graph the derivative of a function given numerically with data. Find where a function is not differentiable and distinguished between corners, cusps, discontinuities, and vertical tangents.		Notes Worksheets, AP Classroom Delta Math IXL TI Graphing Calculator	Quizzes and Tests	

	Approximate derivatives numerically and graphically. Use the rules of differentiation to calculate derivatives, including second and higher order derivatives. Use the derivative to calculate the instantaneous rate of change. Use derivatives to analyze straight line motion and solve other problems involving rates of change. Use the rules for differentiating the six basic trigonometric functions. Find derivatives using the Power Rule for Rational Powers of x. Calculate derivatives of exponential and logarithmic functions.				

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Unit 3	**Differentiation" Composite, Implicit, and Inverse Functions**
Big Idea	**Students learn how to differentiate composite functions using the chain rule and apply that understanding to determine derivatives of implicit and inverse functions**
Unit Essential Questions:	**Calculus allows us to analyze the behaviors of functions by relating limits to differentiation, integration and relating each of these concepts to the others**
Total Number of Days for Unit	**6**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Differentiate composite functions using the Chain Rule. Find derivatives using implicit differentiation. Differentiate Inverse Functions Calculate derivatives of functions involving the inverse trigonometric functions. Selecting Procedures for		Notes Worksheets, AP Classroom Delta Math IXL TI Graphing Calculator	Quizzes and Tests	

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	Calculating Derivatives Calculate Higher order derivatives				

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Unit 4	**Contextual Applications of Differentiation**
Big Idea	**Develop an understanding of average rate of change and instantaneous rate of change in problems involving motion.**
Unit Essential Questions:	**Using derivatives to describe rates of change of one variable with respect to another or using definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus - a central idea of Calculus** **Beginning with a discrete model and then considering the consequences of a limiting case allows is to model real-world behavior and to discover and understand important ideas, definitions, formulas, and theorems in calculus for example, continuity, differentiation, integration.**
Total Number of Days for Unit	**10**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Interpreting the meaning of derivative in context Straight Line Motion: Connecting, Position, Velocity and Acceleration Rates of Change in applied contexts other than motion		Notes Worksheets, AP Classroom Delta Math IXL	Quizzes and Tests	

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	Introduction to related rates Solving related rates problems Approximating values of a function using local linearity and linearization Using L'Hospital's Rule for determining limits of indeterminate forms		TI Graphing Calculator		

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Unit 5	**Analytical Applications of Differentiation**
Big Idea	**Reasoning with definitions and theorems establishes that answers and conclusions are more than just conjectures; they have been analytically determined.**
Unit Essential Questions:	**Calculus allows us to analyze the behaviors of functions by relating limits to differentiation, integration and relating each of these concepts to the others**
Total Number of Days for Unit	**10**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Using the mean value theorem Extreme Value Theorem, global versus local extrema and critical points Determining intervals on which a function is increasing or decreasing Using the first derivative test to determine relative(local) extrema Using the candidates test to determine absolute(global)		Notes Worksheets, AP Classroom Delta Math IXL TI Graphing Calculator	Quizzes and Tests	

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	extrema Determining concavity of functions over their domains Using the second derivative test to determine extrema Sketching graphs of functions and their derivatives Connecting a function, its first derivative and its second derivative Introduction to optimization problems Solving optimization problems Exploring behaviors of implicit relations				

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Unit 6	**Integration and Accumulation of Change**
Big Idea	**This unit establishes the relationship between differentiation and integration using the Fundamental Theorem of Calculus.**
Unit Essential Questions:	**Using derivatives to describe rates of change of one variable with respect to another or using definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus - a central idea of Calculus** **Beginning with a discrete model and then considering the consequences of a limiting case allows is to model real-world behavior and to discover and understand important ideas, definitions, formulas, and theorems in calculus for example, continuity, differentiation, integration.** **Calculus allows us to analyze the behaviors of functions by relating limits to differentiation, integration and relating each of these concepts to the others**
Total Number of Days for Unit	**15**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Exploring Accumulation of Change Approximating Areas with Riemann Sums Riemann Sums, Summation Notation and definite integral		Notes Worksheets, AP Classroom Delta Math	Quizzes and Tests	

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	notation The fundamental theorem of calculus and accumulation functions Interpreting the behavior of accumulation functions involving areas Applying properties of definite integrals The Fundamental Theorem of Calculus and definite Integrals Finding antiderivatives and indefinite integrals, basic rules and notation Integrating using Substitution Integrating functions using long division and completing the square Selecting techniques for antidifferentiation		IXL TI Graphing Calculator		

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Unit 7	**Differential Equations**
Big Idea	**Students will learn to set up and solve separable differential equations. Slope fields can be used to represent solutions to curves to a differential equation and build understanding that there are infinitely many general solutions to a differential equation, varying only by a constant of integration.**
Unit Essential Questions:	**Calculus allows us to analyze the behaviors of functions by relating limits to differentiation, integration and relating each of these concepts to the others**
Total Number of Days for Unit	**10**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Modelling Situations with differential equations Verifying solutions for differential equations Sketching slope fields Reasoning using slope fields Finding general solutions using separation of variables Finding particular solutions using initial conditions and separation of		Notes Worksheets, AP Classroom Delta Math IXL TI Graphing Calculator	Quizzes and Tests	

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	variables Exponential models with differential equations				

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Unit 8	**Applications of Integration**
Big Idea	**Students will learn how to find the average value of a function, model particle motion and net change, and determine areas and volumes.**
Unit Essential Questions:	**Using derivatives to describe rates of change of one variable with respect to another or using definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus - a central idea of Calculus**
Total Number of Days for Unit	**10**

Dates/weeks	PA Standards/ Eligible Content	Vocabulary	Instructional Materials	Common Assessments	Link to Profile of a Zephyr
	Finding the average value of a function on an interval Connecting position, velocity and acceleration of functions using integration Using accumulation function and definite integrals in applied contexts Finding the area between curves expressed as functions of x		Notes Worksheets, AP Classroom Delta Math IXL TI Graphing Calculator	Quizzes and Tests	

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	Finding the area between curves expressed as functions of y Finding the area between curves that intersect in more than two points Volumes with cross sections, squares and rectangles Volume with cross sections triangles and semicircles Volumes with disc method; revolving around the x or y-axis Volume with disc method; revolving around other axes Volume with washer method; revolving around the x or y-axis Volume with washer method; revolving around other axes				