

SUBJECT: AP Calculus AB		GRADE: 9-12	
Unit Title: Unit 1 - Functions and Graphs	Time Frame: 4 weeks		
UNIT OVERVIEW			
● How are equations solved and used to model real life problems? ● What are functions, how are they analyzed, and how are they graphed? ● What are power and higher degree polynomial functions? ● How are zeros of functions calculated? ● How are rational equations solved and how are rational functions graphed? ● How are polynomial, rational and other inequalities solved?			
LRG SKILLS AND DISPOSITIONS		PA STANDARDS	
		CC.2.1.HS.BC C.2.1.HS.C CC.2.1.HS.D CC.2.1.HS.E CC.2.1.HS.F CC.2.2.HS.A CC.2.2.HS.B CC.2.2.HS.C CC.2.2.HS.D CC.2.1.HS.F.3 CC.2.1.HS.F.4 CC.2.1.HS.F.6 CC.2.1.HS.F.7 CC.2.2.HS.D.2 CC.2.2.HS.D.4 CC.2.2.HS.D.5 CC.2.2.HS.D.6 CC.2.2.HS.D.7 CC.2.2.HS.D.9 CC.2.2.HS.D.10 CC.2.2.HS.C.1 CC.2.2.HS.C.2 CC.2.2.HS.C.3 CC.2.2.HS.C.4 CC.2.2.HS.C.5 CC.2.2.HS.C.6	

COMPETENCIES	LEARNING TARGETS
Equations and Inequalities I can create and solve equations and inequalities that represent mathematical situations. Patterns, Functions, Multiple Rep I can identify, create, and evaluate functions using multiple representations Graphing I can create and interpret graphs as visual representations of the relationship between quantities.	Model & Solve Equations I can model and solve equations. (K1MAB5R1) Function Properties - I can identify functions and their properties. (K1MAB6R1) Combine Functions - I can combine functions algebraically. (K1MAB6R2) Parametric Relations - I can define relations parametrically. (K1MAB6R3) Inverse Functions - I can find the inverse of a function. (K1MAB6R4) Transformations - I can recognize function transformations. (K1MAB6R5) Function Modeling - I can model using functions from formulas, graphs, descriptions and data. (K1MAB6R6) Rational Equations - I can solve rational equations. (K1MAB5R2) Polynomial & Rational Inequalities - I can solve polynomial, rational and other inequalities. (K1MAB5R3) Linear & Quadratic Models - I can use data sets to create linear and quadratic models. (K1MAB6R7) End Behavior - I can describe end behavior of functions. (K1MAB6R8) Rational Zeros - I can use factoring, long division and synthetic division to find rational zeros. (K1MAB6R9) Real & Complex Zeros - I can find real and complex zeros. (K1MAB6R10) Linear & Quadratic Graphs - I can graph linear and quadratic functions. (K1MAB7R1) Power & Polynomial Graphs - I can graph power and polynomial functions of higher degree. (K1MAB7R2) Rational Function Graphs

	I can graph rational functions using end behavior and asymptotes. (K1MAB7R3)

SUBJECT: AP Calculus AB		GRADE: 9-12	
Unit Title: Unit 2 – Derivatives		Time Frame: 8 weeks	
UNIT OVERVIEW			
● What are limits, how do we evaluate them, how do we discover continuity, and how do we find asymptotic behavior? ● What is the limit definition of the derivative of a function and what does a derivative represent? ● What is the difference between the average rate of change and the instantaneous rate of change of a function? ● When are functions not differentiable? ● What are the rules of differentiation and how is differentiation applied to motion? ● What is implicit differentiation?			

- How is differentiation used to find higher order derivatives?

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
• Collaboration and Teamwork 9-12: Derivatives Presentation (S1C) • Critical Thinking and Problem Solving 9-12: Derivatives Presentation (S4C)	
COMPETENCIES	LEARNING TARGETS
Limits and Continuity I can determine limits and identify continuity of functions. Derivatives and Integrals I can find, interpret, and use derivatives and integrals to solve problems.	Limit Notation • I can use limit notation. (K1MAB12S1) One-sided Limits • I can evaluate one-sided limits and limits involving infinity. (K1MAB12S2) Limit Existence • I can evaluate when limits do not exist. (K1MAB12S3) Limits of Functions • I can determine limits of functions. (K1MAB12S4) Descriptions using Limits • I can use limits to describe asymptotic and unbounded behavior. (K1MAB12S5) Continuity • I can define continuity. (K1MAB12S6) Discontinuities • I can identify types of discontinuities. (K1MAB12S7) Intermediate Value Theorem • I can apply the intermediate value theorem. (K1MAB12S8) Derivative as Rate of Change • I can understand the meaning of a derivative as the instantaneous rate of change. (K1MAB13S1) Limit Definition of Derivative • I can apply the limit definition of derivative. (K1MAB13S2) Average Rate of Change

	- I can estimate the derivative from graphs and tables using average rate of change. (K1MAB13S3) Slope of Tangent Line - I can solve problems involving the slope of the tangent line at a point. (K1MAB13S4) Differentiability and Continuity - I can recognize the connection between differentiability and continuity (K1MAB13S5) Non-differentiability - I can identify and classify points at which a function is not differentiable. (K1MAB13S6) Derivative Rules - I can use derivative rules. (K1MAB13S7) Product and Quotient Rules - I can use the product and quotient rules (K1MAB13S8) Higher Order Derivatives - I can use differentiation to find higher order derivatives. (K1MAB13S9) Applications of Derivatives - I can solve applications of derivatives involving linear motion. (K1MAB13S10) Chain and Power Rules - I can use the chain and power chain rules. (K1MAB13S12) Implicit Differentiation - I can find derivatives implicitly. (K1MAB13S13) Derivative of an Inverse - I can find derivatives of f inverse at $(f(a), a)$, given $(a, f(a))$ and $f'(a)$. (K1MAB13S14)
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SUBJECT: AP Calculus AB		GRADE: 9-12	
Unit Title: Unit 3 – Applications of Derivatives		Time Frame: 6 weeks	

UNIT OVERVIEW	
- How is differentiation used to solve related rate problems? - How are derivatives used to analyze functions? - How are derivatives used to solve optimization problems?	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
- Collaboration and Teamwork 9-12: Related Rates Presentation (S1C) - Critical Thinking and Problem Solving 9-12: Related Rates Presentation (S4C)	
COMPETENCIES	LEARNING TARGETS
Derivatives and Integrals I can find, interpret, and use derivatives and integrals to solve problems.	Related Rates - I can solve applications of derivatives involving related rates. (K1MAB13S17) Function Behavior and Extreme Values - I can use derivatives to analyze function behavior and find points of extremity. (K1MAB13S18) Mean Value Theorem - I can apply the mean value theorem to describe the behavior of a function over an interval. (K1MAB13S19) Concavity and POI - I can use derivatives to analyze function concavity and points of inflection. (K1MAB13S20) Optimization - I can solve applications of derivatives involving optimization. (K1MAB13S21)

SUBJECT: AP Calculus AB		GRADE: 9-12			
Unit Title: Unit 4 – Exponential, Logistic and Logarithmic Functions	Time Frame: 6 weeks				
UNIT OVERVIEW					
● What are exponential and logistic functions and how are they used to model growth and decay? ● What are logarithmic functions and their properties? ● How are exponential, logistic and logarithmic functions graphed? ● How are exponential and logarithmic functions solved? ● How are exponential models used in the mathematics of finance?					
LRG SKILLS AND DISPOSITIONS		PA STANDARDS			
		CC.2.1.HS.F.3 CC.2.2.HS.D.8 CC.2.2.HS.C.2 CC.2.2.HS.C.6	CC.2.1.HS.F.4 CC.2.2.HS.D.9 CC.2.2.HS.C.3	CC.2.2.HS.D.2 CC.2.2.HS.D.10 CC.2.2.HS.C.4	CC.2.2.HS.D.7 CC.2.2.HS.C.1 CC.2.2.HS.C.5
COMPETENCIES		LEARNING TARGETS			
Derivatives and Integrals		Log Equations			

I can find, interpret, and use derivatives and integrals to solve problems.

Equations and Inequalities

I can create and solve equations and inequalities that represent mathematical situations.

Patterns, Functions, Mult Rep

I can identify, create, and evaluate functions using multiple representations.

Graphing

I can create and interpret graphs as visual representations of the relationship between quantities.

- I can use the properties of logarithms to solve equations. (K1MAB5R4)

Exp, Log, Logistic Equations

- I can solve exponential, logistic, and logarithmic equations algebraically. (K1MAB5R5)

Exp, Log, Logistic Models

- I can use exponential, logistic and logarithmic functions to model and solve real life applications. (K1MAB6R11)

Finance

- I can apply and use interest formulas to solve the mathematics of finance applications. (K1MAB6R12)

Exp and Log Derivatives

- I can find derivatives of exponential and logarithmic functions. (K1MAB13S16)

SUBJECT: AP Calculus AB		GRADE: 9-12	
Unit Title: Unit 5 – Integrals		Time Frame: 8 weeks	
UNIT OVERVIEW			
- What are integrals? - How are integrals evaluated and approximated? - What are antiderivatives and how are they used to evaluate integrals? - What is the Fundamental Theorem of Calculus? - How are derivatives and integrals found using the FTC? - What are slope fields and how are they used to determine solution graphs? - How are differentiable equations solved? - What are antiderivatives and how are they used? - How are integrals evaluated using u-substitution? - How is separation used to solve differential equations?			
LRG SKILLS AND DISPOSITIONS		PA STANDARDS	
COMPETENCIES		LEARNING TARGETS	
Derivatives and Integrals I can find, interpret, and use derivatives and integrals to solve problems.		Integral Approximation Methods - I can approximate a definite integral using rectangular and trapezoidal methods. (K1MAB13S22) Riemann Sums and Definite Integrals - I can interpret and express the limit of a Riemann sum as a definite integral using integral notation. (K1MAB13S23) Definite Integral Evaluation	

- I can calculate a definite integral using geometry and properties of definite integrals. (K1MAB13S24)

Antiderivatives

- I can recognize antiderivatives of basic functions. (K1MAB13S25)

Fundamental Theorem of Calculus

- I can find the derivative of a function defined as an integral using the Fundamental Theorem of Calculus. (K1MAB13S26)

Functions defined as Integrals

- I can analyze functions defined by an integral. (K1MAB13S27)

Evaluating Integrals by the FTC

- I can evaluate indefinite and definite integrals using antiderivatives and the Fundamental Theorem of Calculus. (K1MAB13S28)

Solving Differential Equations

- I can analyze differential equations to obtain general and specific solutions. (K1MAB13S29)

Estimating Solutions of Differential Equations

- I can verify and estimate solutions of differential equations. (K1MAB13S30)

Slope Fields

- I can analyze differential equations by identifying characteristics of their slope fields. (K1MAB13S31)

Find Antiderivatives

- I can find antiderivatives. (K1MAB13S32)

U-Substitution

- I can evaluate indefinite and definite integrals using u-substitution (K1MAB13S33)

Separation of Variables

- I can analyze differential equations to obtain general and specific solutions using separation of variables. (K1MAB13S34)

Exponential Growth

- I can interpret, create, and solve differential equations from problems in context (specifically exponential growth) (K1MAB13S35)

Unit Title: Unit 6 – Applications of Integration	Time Frame: 6 weeks
UNIT OVERVIEW	
• How are integrals used to evaluate net change? • How are integrals used to find the average value of a function? • How are integrals used to calculate areas • How are integrals used to calculate volumes?	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
• Collaboration and Teamwork 9-12: Applications of Integration Presentation (S1C) • Critical Thinking and Problem Solving 9-12: Applications of Integration Presentation (S4C)	
COMPETENCIES	LEARNING TARGETS
Derivatives and Integrals I can find, interpret, and use derivatives and integrals to solve problems.	Integrals as Net Change • I can interpret a definite integral as net change of a quantity. (K1MAB13S36) Linear Motion • I can apply definite integrals to problems involving linear motion. (K1MAB13S37) Average Value of a Function • I can apply definite integrals to problems involving the average value of a function. (K1MAB13S38) Area and Volume • I can apply definite integrals to problems involving area and volume (K1MAB13S39)

SUBJECT: AP Calculus AB

GRADE: 9-12

Unit Title: Unit 7 – L'Hopital's Rule and AP Exam Preparation	Time Frame: 4 week
UNIT OVERVIEW	
- How are limits of indeterminate forms evaluated? - How are MC and FR questions answered on AP Exam format assessments?	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Resilience and Grit 9-12: AP Calculus AB Simulation Exam (D4C)	
COMPETENCIES	LEARNING TARGETS
Limits and Continuity I can determine limits and identify continuity of functions.	L'Hopital's Rule I can find limits of indeterminate forms using L'Hopital's Rule. (K1MAB12S9)