Hamburg Area School District

Course Guide

Name:	AP Calculus AB (1490)
Grade(s):	*12*
Length:	*Place an X next to the correct option*
X	Full-Year (180 Sessions)
	Semester (90 Sessions)
	Quarter (45 Sessions)
	Other (Specify):
Text:	Larson, Hostetler, Edwards. *Calculus*. 8th Edition. 2006. (Houghton Mifflin)
Approved on:	2007-2008 (Reviewed 2021-2022)

Description:

This is a college level course. The class pursues a discussion on curve sketching, differential calculus and integral calculus. Applications of differentiation and integration will be covered in depth. This course is focused on preparing for the Advanced Placement exam, and it will be studied through the use of the graphing calculator.

AP Calculus AB

Unit: Analysis of Graphs
Unit Length: *1 week*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Linear and Absolute Value Equations	Graph linear equations using slope. Graph absolute value equations. Graph transformations of basic linear and absolute value equations.	M11.D.2.1.2 M11.D.4.1.1 2.8.11.S
Polynomial and Rational Equations	Graph polynomial equations. Graph rational equations. Identify asymptotes.	2.8.11.S
Trigonometric and Transcendental Equations	Graph trigonometric equations. Identify period, amplitude, and other transformations. Graph transcendental equations. Identify asymptotes.	2.8.11.S
Graphing Calculators	Graph functions on a graphing calculator.	2.8.11.S

AP Calculus AB

Unit: Limits of Functions
Unit Length: *3 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Calculating Limits	Calculate one-sided limits. Calculate two-sided limits. Decide when a limit does not exist.	2.11.11.A 2.11.11.B 2.11.11.C 2.11.11.D 2.11.11.E
Calculate Limits Using Algebra	Evaluate a limit using properties of limits. Evaluate a limit by dividing out and rationalizing techniques. Evaluate a limit using theSqueeze Theorem.	2.11.11.A 2.11.11.B 2.11.11.C 2.11.11.D 2.11.11.E
Estimating Limits	Estimating limits using a graph. Estimating limits using a table.	2.11.11.A 2.11.11.B 2.11.11.C 2.11.11.D 2.11.11.E

AP Calculus AB

Unit: Continuity as a Property of Functions
Unit Length: *2 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Understand continuity in terms of limits.	Define continuity at a point. Identify the intermediate value theorem and its application.	2.11.11.A
Understand geometric graphs of continuous and discontinuous functions.	Use properties of continuity. Identify an infinite limit of a function and determine asymptotic nature of the curve. Identify vertical and horizontal asymptotes of functions.	2.11.11.D

AP Calculus AB

Unit: Asymptotic and Unbounded Behavior
Unit Length: *1 week*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Relative magnitudes of graphs and rates of change	Identify how rates of change are affected by magnitudes of graphs with asymptotic behavior.	2.11.11.C
Describe asymptotic behavior in terms of limits involving infinity.	Identify an infinite limit of a function and determine asymptotic nature of the curve.	2.11.11.D

AP Calculus AB

Unit: Concept of the Derivative
Unit Length: *2 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Derivative defined as the limit of the difference quotient.	Extend the idea of limits of the secant line to the tangent line.	2.11.11.C
Relationship between differentiability and continuity.	Use the definition of continuity to establish if a function is differentiable.	2.11.11.C

AP Calculus AB

Unit: Derivative at a Point
Unit Length: *3 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Slope of a curve at a point.	Distinguish the difference between finding a point of tangency and evaluating the derivative at the same value as the point of tangency.	M11.D.3.1.1 2.11.11.C
Tangent line to a curve at a point.	Write the equation of the line in point-slope form that contains the point tangent to the curve at the given point.	2.11.11.C
Instantaneous rate of change as the limit of average rate of change.	Distinguish between average velocity and instantaneous velocity. Find velocity, acceleration, and other rates of change.	2.11.11.C

AP Calculus AB

Unit: Derivative as a Function
Unit Length: *2 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Basic differentiation rules.	Apply the power rule. Apply the product and quotient rules.	2.11.11.C
Distinguish between functions that are implicit and explicit.	Determine if the function can be solved easily with respect to one variable. Given a function in terms of two variables, differentiate it implicitly.	2.11.11.C
Corresponding characteristics of graphs of f and f'.	Find critical points of both types; stationary and non differentiable.	2.11.11.C

AP Calculus AB

Unit: Higher Order Derivatives
Unit Length: *1 week*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Corresponding characteristics of graphs of f, f', and f".	Find points of inflection. Establish the relationship of points of inflection and concavity.	2.11.11.C

AP Calculus AB

Unit: Applications of Derivatives
Unit Length: *4 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Calculate related rates verbals.	Solve problems using implicit differentiation to find a rate of change with respect to time.	2.11.11.C
Find intervals of increase and decrease.	Use the first derivative test to determine where a function is increasing and decreasing by slope.	2.11.11.C
Determine relative extrema.	Define extrema on an interval. Use the second derivative test to determine extrema.	2.11.11.A 2.11.11.B
Analysis of curves.	Be able to graph polynomial functions and rational functions using extrema without the use of a graphing calculator.	2.11.11.A 2.11.11.B
Determine maximum and minimum values of a function.	Distinguish between relative maximum and minimum and absolute maximum and minimum values. Extend the idea of maximum and minimum values to problems involving optimization.	2.11.11.B 2.11.11.C

AP Calculus AB

Unit: Applications of Derivatives
Unit Length: *4 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Given a function, approximate the zeros.	Use Newton's method to approximate the zeros of a function.	2.11.11.A 2.11.11.B
Apply Rolle's Theorem and the Mean-Value Theorem.	Define Rolle's Theorem. Define the Mean-Value Theorem.	2.11.11.A 2.11.11.B
Understand rectilinear motion.	Use the derivatives to show motion along a line of a particle in motion.	2.11.11.A 2.11.11.B

AP Calculus AB

Unit: Riemann Sums
Unit Length: *1 week*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Concept of a Riemann sum over equal subdivisions.	Determine use of summation formulas.	2.11.11.D
Computation of Riemann sums.	Evaluate sums for the definite integral.	2.11.11.D

AP Calculus AB

Unit: Logarithm and Exponential Functions
Unit Length: *2 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Given exponential functions, calculate their derivatives.	Use properties of exponents and rules of derivatives to calculate derivatives of exponential functions.	2.11.11.C
Given natural logarithmic functions, calculate their derivatives.	Use properties of logarithms and rules to calculate derivatives of natural logarithmic functions.	2.11.11.C
Given exponential functions, calculate their antiderivatives.	Use the rules of integration to calculate the antiderivative of exponential functions	2.11.11.E
Given natural logarithmic functions, calculate their antiderivatives.	Use the rules of integration to calculate the antiderivative of natural logarithmic functions.	2.11.11.E

Unit: Integration
Unit Length: *3 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Given functions, determine the integral.	Define an antiderivative. Apply basic integration rules to functions. Define the need for a constant of integration. Apply integration by substitution for indefinite integrals.	2.11.11.E
Given functions with bounds, determine the integral.	Apply integration rules for definite integrals. Apply integration by substitution for definite integrals. Use the First Fundamental Theorem of Calculus to calculate the definite integral. Find the value of a c guaranteed by the Mean- Value Theorem of integrals over a specified interval. Use the Second Fundamental Theorem of Calculus by taking the derivative.	2.11.11.E

Unit: Applications of the Integral
Unit Length: *3 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Given two functions, find the area of the region by use of dy/dx.	Given a region trapped between two curves, calculate the area.	2.11.11.E
Given one or two curves, find the volume of the region formed by revolving about a given axis.	Given a curve, calculate the volume of revolution about a given axis by use of the disc method. Given two curves, calculate the volume of revolution about a given axis by use of the washer method.	2.11.11.E
Given one or two curves, find the volume of the region formed by revolving about a given axis opposite the independent variable.	Calculate the volume of revolution about a given axis by use of cylindrical shells.	2.11.11.E
Given one function, find the surface area of the region formed by revolving about a given axis.	Calculate the area of a surface of revolution about a given axis.	2.11.11.E
Given a second derivative, find the original function.	Apply integration to rectilinear motion by integrating the acceleration function to calculate the velocity function and the distance or position function.	2.11.11.E
Determine work needed by constant and variable force.	Given a function or write a function using Hooke's law to integrate to determine work done with a force.	2.11.11.E

AP Calculus AB

Unit: Inverse Trigonometric and Hyperbolic Functions
Unit Length: *1 week*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Review inverse trigonometric functions.	Graph the inverse trigonometric functions by use of restricted domains for passing function test.	2.10.11.B
Given inverse trigonometric functions, find the derivative or the integral.	Memorize derivatives and integration formulas for all inverse trigonometric functions.	2.11.11.C 2.11.11.E
Given hyperbolic and inverse hyperbolic functions, find the derivative or the integral.	Memorize derivates and integration formulas for all hyperbolic and inverse hyperbolic functions.	2.11.11.C 2.11.11.E

AP Calculus AB

Unit: Improper Integrals
Unit Length: *1 week*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Given various types of problems to integrate, students will integrate them.	Integrate a variety of functions by recognizing the appropriate integral form (using prior knowledge and formulas).	2.11.11.E
Given various types of problems to integrate, students will integrate them.	Recognize forms of functions that require integration by parts	2.11.11.E
Recognizing problems of indeterminate form.	Apply L'Hopital's rule to evaluate a limit.	2.11.11