Wyoming Department of Education Required Virtual Education Course Syllabus

BIG HORN COUNTY SCHOOL DISTRICT #1

Program Name	WYCA	Content Area	Mathematics
Course ID	CAMA77662	Grade Level	9, 10, 11, 12
Course Name	AP Calculus AB A	# of Credits	0.5
SCED Code	02124E0.5011	Curriculum Type	Connections Academy

COURSE DESCRIPTION

AP Calculus AB, semester A is a college-level course covering such concepts as derivatives, integrals, limits, approximation, applications, and modeling. In the first semester, the student will begin by reviewing function notation, before exploring absolute value, piecewise, exponential, logarithmic, trigonometric, polynomial, and rational functions. After studying limits and continuity, the student will move on to concepts of derivatives, including the chain rule, differentiation, implicit differentiation, and logarithmic differentiation.

WYOMING CONTENT AND PERFORMANCE STANDARDS

STANDARD#	BENCHMARK
A.SSE.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)^n as the product of P and a factor not depending on P.*
A.SSE.2	Use the structure of an expression to identify ways to rewrite it. For example, see x^4 – y^4 as (x^2)^2 – (y^2)^2, thus recognizing it as a difference of squares that can be factored as (x^2 – y^2)(x^2 + y^2).
F.IF.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
F.IF.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
F.IF.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative
F.IF.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
F.IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
F.IF.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
F.IF.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.*
F.IF.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.*
F.IF.7d	(+)Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.*
F.IF.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*
F.IF.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
F.IF.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
F.BF.1	Write a function that describes a relationship between two quantities.*
F.BF.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
F.BF.1b	Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
F.BF.1c	(+)Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.
F.BF.3	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic
F.BF.5	(+)Build new functions from existing functions. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
F.LE.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.*
F.LE.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*
F.LE.5	Interpret the parameters in a linear or exponential function in terms of a context.*
F.TF.7	(+)Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.*

SCOPE AND SEQUENCE

UNIT OUTLINE	STANDARD#	OUTCOMES
Unit 1: Functions In this unit, you will learn what calculus is all about. You will review function terminology, function composition and transformation, and how to use a graphing calculator.	A.SSE.1b; A.SSE.2; F.IF.1; F.IF.2; F.IF.4; F.IF.5; F.IF.6; F.IF.7; F.IF.7a; F.IF.7c; F.IF.7d; F.IF.7e; F.IF.8; F.IF.9; F.BF.1; F.BF.1a; F.BF.1b; F.BF.1c; F.BF.5; F.LE.1; F.LE.2; F.LE.5; F.TF.7	•understand the background of calculus identify overall subjects which will be learned throughout the course •determine whether a relation is a function •determine a function's domain and range •use a graphing calculator •graph functions •perform combinations of functions arithmetically or through composition to create new functions •perform translations, reflections, and expansions/compressions on functions •use technology such as a graphing calculator to experiment with functions •understand the properties of power functions, polynomial and rational functions, and trigonometric functions •use graphing calculators to explore the effects of changing any parameters of various functions on their corresponding graphs

Unit 2: Limits and Continuity In this unit, you will learn about limits and their properties and the continuity of functions. You will also learn about real-world application of limits.	A.SSE.1b; A.SSE.2; F.IF.1; F.IF.2; F.IF.4; F.IF.5; F.IF.6; F.IF.7; F.IF.9; F.BF.1; F.BF.3F.BF.5	•use limits to describe the behavior of a function •use a graphing calculator to get numerical approximations for limits •evaluate the behavior of a function (in terms of limits) graphically (through sketching by hand and by using a graphing calculator) numerically and algebraically •understand the connection between vertical asymptotes and (infinite) limits and use graphing calculators to support conclusions •evaluate the behavior of a function (in terms of limits) graphically (through sketching by hand and by using a graphing calculator) •evaluate the behavior of a function (in terms of limits) numerically •evaluate the behavior of a function (in terms of limits) algebraically •use limits to describe the behavior of a function •use a graphing calculator to get numerical approximations for limits •understand the connection between horizontal asymptotes and the end behavior of a function •use a graphing calculator to help explore the connection between horizontal asymptotes and the end behavior of a function •use limits to describe the behavior of a function •use a graphing calculator to get numerical approximations for limits •understand the connection between limits and continuity •use a function's continuity to evaluate its limit at a point •be able to determine when a function is continuous (or discontinuous) •understand how a graphing calculator can explore further when a function is continuous or discontinuous and know its limitations •identify the approximate roots of a function using the Intermediate Value Theorem
Unit 3: Differentiation In this unit, you will learn about the derivative. You will learn the rules for differentiation and take derivatives of all types of functions such as exponential, logarithmic, and trigonometric.	A.SSE.1b; A.SSE.2; F.IF.1; F.IF.2; F.IF.4; F.IF.5; F.IF.6; F.IF.7; F.IF.9; F.BF.1; F.BF.3; F.BF.5	•understand the definition of the derivative as a local linear approximation and what it implies, as well as differentiability, and use graphs to explore tangent lines •understand the different notations for the derivative •explore the relationship between the graph of a function and its derivative •explore further the characteristics of the graphs of f and f'. •develop derivatives of polynomial functions •use the product/quotient rules to find derivatives •develop derivatives of trigonometric functions •use the product/quotient rules to find derivatives •use the chain rule of Newton's form to find the derivatives of composite functions •use the chain rule of Leibniz's form to find the derivatives of composite functions •understand the properties of exponential and logarithmic functions •use a graphing calculator to explore the effects of changing any parameters of exponential functions on their corresponding graph •use a graphing calculator to explore the effects of changing any parameters of logarithmic functions on their corresponding graph •use the product/quotient rules to find derivatives •use the chain rule (both Newton and Leibniz's forms) to find the derivatives of composite functions •develop derivatives of logarithmic functions •develop derivatives of exponential and inverse trigonometric functions •use implicit differentiation to find the derivative/slope of a curve that is defined implicitly •use logarithmic differentiation to find derivatives

Unit 4: Applications of Derivatives In this unit, you will apply what you have been learning about derivatives to sketching graphs of functions by hand. You will also apply your knowledge to describe real-world phenomena mathematically.	A.SSE.1b; A.SSE.2; F.IF.1; F.IF.2; F.IF.4; F.IF.5; F.IF.6; F.IF.7; F.IF.9; F.BF.1; F.BF.3; F.BF.5	•determine the concavity of a function and discuss its implications on the shape of the curve •find critical points, find critical points and points of inflection, and points of inflection •determine the intervals for where a function is increasing or decreasing; analytically, numerically, and with a graphing calculator •sketch the curve of a function based upon information from its first and second derivatives and vice versa •determine the intervals for where a function is increasing or decreasing; analytically, numerically, and with a graphing calculator •sketch the curve of a function based upon information from its first and second derivatives and vice versa •determine the global or absolute extrema of a function on a closed interval, using both algebraic analytical techniques with the 1st, 2nd, or both derivatives as well as with the use of a graphing calculator •use derivatives to discuss the motion and rate of change of objects in terms of distance and displacement, velocity, speed, and acceleration •use derivatives to discuss rectilinear motion •use derivatives to solve related rate problems •model how the rates of different quantities that depend upon the same parameter, such as time, interact •use the Mean Value Theorem for Derivatives to make conclusion about a function on certain intervals (and point within those intervals) and explore the results via graphical methods •evaluate limits involving indeterminate forms using L'Hôpital's Rule •understand the definition of the derivative as a local linear approximation and what that implies •understand differentiability and use graphs to explore tangent lines •understand the different notations for the derivative •explore the relationship between the graph of a function and its derivative •explore the characteristics of the graphs of f, f ', and f '' •use local linear approximation or differentials to aid in approximations techniques