School District of Marshfield Course Syllabus

Course Name: AP Calculus BC
Length of Course: 1 Year
Credit: 1

Program Goal(s):

The School District of Marshfield Mathematics Program will prepare students for college and career in the 21st century by ensuring ***all*** students learn based on skills and knowledge needed to succeed in post-secondary education/training, career, and life. The 4K through High School Mathematics curriculum is designed to support every student in achieving success. Students will be placed in to the driver's seat. Innovative educators will tailor instruction to student need through engaging learning activities and relevant assessment.

Course Description:

This course covers the curriculum for Advanced Placement Calculus as put forth by the College Board. AB topics include limits, derivatives, and integrals: their computations, their applications to problem solving, and the relationships among them. The BC course includes all AB material, plus improper integrals, infinite series, and the calculus of parametric, vector, and polar functions.

Standards:	
Functions	• Review function concepts and terminology (such as asymptotes, symmetry, intercepts, compositions of, domain, range) • Review families of functions • Review graphs and properties of trigonometric, inverse trig, exponential, and logarithmic functions • Compare rates of growth of functions • Review common trigonometric values • Produce and interpret graphs of functions on the graphing calculator • Find roots of equations on the graphing calculator
Limits and Continuity **EU 1.1:** The concept of a limit can be used to understand the behavior of functions. **EU 1.2:** Continuity is a key property of functions that is defined using limits.	• Estimate limits from graphs • Estimate limits from tables • Calculate limits algebraically from equations • Describe continuity of functions geometrically • Define continuity in terms of limits • Consider Intermediate Value Theorem and Extreme Value Theorem • Understand limits and continuity intuitively
Derivatives **EU 2.1:** The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies.	• Consider rates of change (average and instantaneous), including slope • Explore local linearity of functions • Define the derivative as a limit • Identify points of nondifferentiability • Use power, product, quotient, and chain rules • Take derivatives of trig and inverse trig functions • Take derivatives of exponential and logarithmic functions • Perform implicit differentiation • Find numerical derivatives on the graphing calculator
Function Analysis **EU 2.2:** A function's derivative, which is itself a function, can be used to understand the behavior of the function.	• Locate critical points, intervals of increase/decrease • Identify inflection points, concavity • Apply 3 tests for extremum • Relate graphs and equations of f, f ', f "
Applications of the Derivative **EU 2.3:** The derivative has multiple interpretations and applications including those that involve instantaneous rates of change.	• Solve problems involving rates of change • Determine equations of tangent lines • Find derivatives of inverse functions • Use the Mean Value Theorem for derivatives • Apply L'Hopital's Rule to limits • Investigate rectilinear motion • Solve related rates problems • Solve applied optimization problems
Integrals **EU 3.1:** Antidifferentiation is the inverse process of differentiation.	• Find antiderivatives by reversing known derivative formulas

EU 3.2: The definite integral of a function over an interval is the limit of a Riemann sum over that interval and can be calculated using a variety of strategies. **EU 3.3:** The Fundamental Theorem of Calculus, which has two distinct formulations, connects differentiation and integration.	• Estimate area with Reimann Sums (right-hand, left-hand, midpoint approximations) • Improve area estimates (use trapezoids and increase number of partitions) • Define definite integral as a limit of Riemann sums • Prove relationship between antiderivatives and area • Use the Fundamental Theorem of Calculus to evaluate integrals • Use U-substitution to evaluate integrals • Find numerical integrals on the graphing calculator • Approximate integrals from equation, tables, and graphs
Applications of the Integral **EU 3.4:** The definite integral of a function over an interval is a mathematical tool with many interpretations and applications involving accumulation.	• Use initial conditions to find specific antiderivatives • Use the Mean Value Theorem for integrals to find the average of a function • Calculate area between curves • Calculate volumes (disk/washer/shell & other slices) • Calculate lengths of curves • Calculate surface area of a solid of revolution • Determine distance and displacement • Interpret the integral as an accumulator • Interpret the integral of a rate of change of a function as net change in the function • Apply the Fundamental Theorem of Calculus
Differential Equations **EU 3.5:** Antidifferentiation is an underlying concept involved in solving separable differential equations. Solving separable differential equations involves determining a function or relation given its rate of change.	• Solve first order separable differential equations • Draw slope fields and integral curves • Use Euler's Method to obtain numerical solutions • Show relationships among differential equations, slope fields, integral curves and Euler's Method • Solve problems of exponential growth and decay • Solve problems of logistic growth
More Integration **EU 3.4:** The definite integral of a function over an interval is a mathematical tool with many interpretations and applications involving accumulation.	• Use Integration by Parts method to evaluate integrals • Use Partial Fractions method to evaluate integrals • Identify integrals with infinite limits or infinite discontinuity as improper • Evaluate improper integrals • Apply L'Hopital's rule to improper integrals • Investigate behavior of $1/x^p$
Parametric Equations and Vectors **EU 2.3:** The derivative has multiple interpretations and applications including those that involve instantaneous rates of change. **EU 3.4:** The definite integral of a function over an interval is a mathematical tool	• Review parametric notation and basics • Graph parametric curves with and without a calculator • Convert between Cartesian and parametric forms of coordinates and equations • Apply derivatives to parametric equations • Calculate lengths of parametric curves • Apply integrals to parametric equations • Review vector notation and operations • Apply derivatives to vector motion

with many interpretations and applications involving accumulation.	• Apply integrals to vector motion
Polar Equations **EU 2.3:** The derivative has multiple interpretations and applications including those that involve instantaneous rates of change. **EU 3.4:** The definite integral of a function over an interval is a mathematical tool with many interpretations and applications involving accumulation.	• Review polar notation and definitions • Graph polar curves with and without a calculator • Convert between Cartesian and polar forms of coordinates and equations • Apply derivatives to polar equations • Identify vertical tangents, horizontal tangents, singular points • Apply integrals to polar equations • Calculate length of polar curves • Calculate area enclosed by polar curves
Series **EU 4.1:** The sum of an infinite number of real numbers may converge. **EU 4.2:** A function can be represented by an associated power series over the interval of convergence for the power series.	• Identify types of series, including arithmetic, geometric, harmonic, alternating, infinite, power, and p-series • Determine convergence of geometric series with formulas • Determine convergence of series from limits of partial sums and from graphs • Determine convergence of series with ratio test, n^{th} term test, comparison test, integral test, and limit comparison test • Analyze absolute and conditional convergence • Represent functions with power series • Identify intervals and radii of convergence • Know "Common Taylor Polynomials" • Construct Taylor Series from formulas • Use substitution, differentiation, and integration to build Taylor Series from known series • Find Lagrange error bound of Taylor Polynomials • Analyze alternating series error bound

Primary Resource(s):

Calculus: AP Edition- Graphical, Numerical, Algebraic, 5th Edition Prentice Hall ISBN: 0-13-331162-7 © 2016	Math XL, Pearson Realize