Northern York County School District

Curriculum Overview

Course: AP Calculus BC	
Grade Level: 12	
Approval Date:	**Length of Time: 180 days**

Course Description:
AP Calculus BC provides students with an additional year's work in collegiate mathematics. There is a concentration on theory as well as the application of calculus principles. This course is designed to follow the AP Calculus BC curriculum provided by The College Board. The course will address topics in both derivative and integral calculus. Topics will fall under one of five major headings: (1) Limits; (2) Continuity; (3) Derivatives; (4) Integration; and (5) Sequence & Series. (Note: AP Calculus BC is designed to prepare students for the advanced placement calculus BC test administered by the College Board. Institutions of higher education may or may not recognize a passing score on this exam for credit.)
Prerequisite: Students must have a teacher recommendation

Course Objectives:
- Use and apply Calculus terminology and theorems appropriately
- Perform and apply differentiation techniques to solve application problems (motion, related-rate, optimization, etc.)
- Perform and apply integration techniques to solve application problems (area under a curve, accumulation of change, volume of a solid, etc.)
- Determine, utilize, and graph differential equations
- Use technology to analyze limits, continuity, derivatives, integrals of functions, as well as sequences and series
- Determine, utilize, and graph polar and parametric equation, and vector-valued functions
- Perform tests to determine the convergence/divergence of sequences and series

Related Standards:
- CC.2.1.HS.F.3 – Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays.
- CC.2.2.HS.D.2 – Write expressions in equivalent forms to solve problems.
- CC.2.2.HS.D.4 – Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
- CC.2.2.HS.D.10 – Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
- CC.2.2.HS.C.2 – Graph and analyze functions and use their properties to make connections between the different representations.
- CC.2.2.HS.C.6 – Interpret functions in terms of the situations they model.
- CC.2.2.HS.C.3 - Write functions or sequences that model relationships between two quantities.
- CC.2.2.HS.D.9 – Use reasoning to solve equations and justify the solution method.

Units

- Limits & continuity
- Differentiation
- Applications of Differentiation
- Integration
- Logarithmic, Exponential, and Transcendental Functions
- Differential Equations
- Applications of Integration
- Other Integration Techniques & Improper Integrals
- Infinite Series
- Parametric & Polar Equations
- Vectors & Vector-Valued Functions

Concepts:

- **Differentiation –** There are many applications that involve differentiation (the slope of a tangent line), such as calculating instantaneous velocity, related rates of change, and maximum/minimum values.
- **Integration** – Determining the accumulation of change, area under a curve, and volume of a solid are a few applications that require integration.
- **Differential Equations –** Writing and solving differential equations leads to models for exponential growth/decay and logistic growth.
- **Infinite Series –** Infinite series have applications in physics, engineering, computer science, and finance
- **Polar and Parametric Equations –** These equations have applications in curvilinear motion problems that cannot be easily described by typical functions
- **Vector-Valued Functions –** Vectors have applications in physics and engineering when working with projectile motion analyzing force, motion, and stress for structural design.

Competencies:

- Evaluate limits graphically, numerically, and analytically including L'Hospital's Rule.
- Explain how limits help to determine features of functions and their graphs.
- Determine the continuity of a function at a point and on an interval.
- Define whether discontinuities are classified as removable or nonremovable and understand their graphical representations.
- Define and estimate the derivative of a function using correct notation.
- Apply rules for finding the derivatives of algebraic and transcendental functions (power rule, constant rule, sum/difference/product/quotient rules, trigonometric rules, chain rule, and implicit differentiation).
- Interpret the meaning of the derivative in the context of the problem and apply it to solve real-life problems (straight-line motion, rates of change, related rates, function value approximations, and optimization).
- Sketch the graphs of functions and their derivatives.
- Apply the Intermediate Value Theorem, Mean Value Theorem, First Derivative Test, and Second Derivative Test.
- Find and approximate the area under a curve using geometry, Riemann Sums, and The Fundamental Theorem of Calculus. Find the area between two curves.
- Apply properties and rules for indefinite and definite integration of functions (power rule, substitution, and integration by parts).

	• Find general and particular solutions to differential equations. • Model differential equations and sketch slope fields. • Determine the volume of a solid by revolving functions around various lines of rotation (disc and washer methods) and using cross sectional area. • Utilize and apply advanced integration techniques including linearization using partial fractions and integration by parts • Utilize the properties of limits to evaluate improper integrals • Apply tests to determine the convergence/divergence of various sequences and series • Identify and define common series such as Geometric, Harmonic, Taylor, and Maclaurin series. • Use sequences and series to model various real-life situations and apply calculus to solve real-life problems. • Identify and define parametric equations and vector-valued functions • Utilize parametric equations and vector-valued functions to describe planar motion and apply calculus to solve real-life problems.
Learning Activities: • Note-taking & Direct Instruction • Presentations/Class Discussions • Experience First, Formalize Later (EFFL) Activities • Practice Tests • Independent Practice	**Performance Tasks:** • Homework • Progress Checks • Free Response Questions • Tests & Quizzes • Projects
Other Assessment Measures: AP exam	
Textbook/Primary Resource: Larson, Calculus 12th Edition - AP Edition	
Supplemental Resource Materials: • District/Teacher created resources • Online resources (such as Khan Academy, College Board AP Classroom. Calc Medic)	