



## Northern York County School District

### Curriculum Overview

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| <b>Course: AP Calculus AB</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                 |
| <b>Grade Level: 11/12</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                 |
| <b>Approval Date:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Length of Time: 180 days</b> |
| <b>Course Description:</b><br>Advanced Placement Calculus AB follows the AP Calculus AB curriculum provided by The College Board. There is a concentration on theory as well as the application of calculus principles. The course will address topics in both derivative and integral calculus. Topics will fall under one of four major headings: (1) Limits; (2) Continuity; (3) Derivatives; and (4) Integration. (Note: AP Calculus AB is designed to prepare students for the Advanced Placement Calculus AB test administered by the College Board. Institutions of higher education may or may not recognize a passing score on this exam for credit.)                                                                                                                                                                              |                                 |
| <b>Prerequisite:</b> Students must have a teacher's recommendation. An Honors Precalculus grade of 77% or higher is recommended.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                 |
| <b>Course Objectives:</b> <ul style="list-style-type: none"><li>• Use and apply Calculus terminology and theorems appropriately</li><li>• Determine and apply limits of functions</li><li>• Utilize limits and continuity to determine differentiability</li><li>• Perform and apply differentiation techniques to solve application problems (motion, related-rate, optimization, etc.)</li><li>• Perform and apply integration techniques to solve application problems (area under a curve, accumulation of change, volume of a solid, etc.)</li><li>• Determine, utilize, and graph differential equations</li><li>• Use technology to analyze limits, continuity, derivatives, and integrals of functions</li></ul>                                                                                                                    |                                 |
| <b>Related Standards:</b> <ul style="list-style-type: none"><li>• CC.2.1.HS.F.3 – Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays.</li><li>• CC.2.2.HS.D.2 – Write expressions in equivalent forms to solve problems.</li><li>• CC.2.2.HS.D.4 – Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.</li><li>• CC.2.2.HS.D.10 – Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.</li><li>• CC.2.2.HS.C.2 – Graph and analyze functions and use their properties to make connections between the different representations.</li><li>• CC.2.2.HS.C.6 – Interpret functions in terms of the situations they model.</li></ul> |                                 |
| <b>Units:</b> <ul style="list-style-type: none"><li>• Limits and Continuity</li><li>• Differentiation: Definition and Fundamental Properties</li><li>• Differentiation: Composite, Implicit, and Inverse Functions</li><li>• Contextual Applications of Differentiation</li><li>• Analytical Applications of Differentiation</li><li>• Integration and Accumulation of Change</li><li>• Differential Equations</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                    |                                 |

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| <ul style="list-style-type: none"> <li>Applications of Integration</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Concepts:</b></p> <ul style="list-style-type: none"> <li><b>Limits</b> – Limits are how a function behaves and bridges prerequisite courses to the study of derivatives and integration.</li> <li><b>Continuity</b> – Continuity of a function establishes a foundation for the study of derivatives and integration.</li> <li><b>Differentiation</b> – 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.</li> <li><b>Integration</b> – Determining the accumulation of change, area under a curve, and volume of a solid are a few applications that require integration.</li> <li><b>Differential Equations</b> – Writing and solving differential equations leads to models for exponential growth/decay and logistic growth.</li> </ul> | <p><b>Competencies:</b></p> <ul style="list-style-type: none"> <li>Evaluate limits graphically, numerically, and analytically including L'Hospital's Rule.</li> <li>Explain how limits help to determine features of functions and their graphs.</li> <li>Determine the continuity of a function at a point and on an interval.</li> <li>Define whether discontinuities are classified as removable or nonremovable and understand their graphical representations.</li> <li>Define and estimate the derivative of a function using correct notation.</li> <li>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).</li> <li>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).</li> <li>Sketch the graphs of functions and their derivatives.</li> <li>Apply the Intermediate Value Theorem, Mean Value Theorem, First Derivative Test, and Second Derivative Test.</li> <li>Find and approximate the area under a curve using geometry, Riemann Sums, and The Fundamental Theorem of Calculus. Find the area between two curves.</li> <li>Apply properties and rules for indefinite and definite integration of functions (power rule, substitution, and integration by parts).</li> <li>Find general and particular solutions to differential equations.</li> <li>Model differential equations and sketch slope fields.</li> <li>Determine the volume of a solid by revolving functions around various lines of rotation (disc and washer methods) and using cross sectional area.</li> </ul> |
| <p><b>Learning Activities:</b></p> <ul style="list-style-type: none"> <li>Warm Up Problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p><b>Performance Tasks:</b></p> <ul style="list-style-type: none"> <li>Quizzes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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| <ul style="list-style-type: none"> <li>• Direct Instruction</li> <li>• Class Discussions/Presentations</li> <li>• Collaboration Activities</li> <li>• Guided Practice</li> <li>• Independent Practice</li> </ul>                 | <ul style="list-style-type: none"> <li>• Unit Tests</li> <li>• Unit Activities</li> <li>• Unit Project(s)/Lab(s)</li> </ul> |
| <b>Other Assessment Measures:</b><br>Homework<br>Classwork<br>Presentations<br>AP Calculus AB Exam                                                                                                                               |                                                                                                                             |
| <b>Textbook/Primary Resource:</b><br>Larson, Calculus 12 <sup>th</sup> Edition - AP Edition                                                                                                                                      |                                                                                                                             |
| <b>Supplemental Resource Materials:</b> <ul style="list-style-type: none"> <li>• District/Teacher Created Resources</li> <li>• Online Resources (Calc Medic, College Board Website, AP Classroom, Khan Academy, etc.)</li> </ul> |                                                                                                                             |