**COURSE DESCRIPTION**

**Course Title:** Honors Calculus

**Course Number:** 00291

**Course Prerequisites:** Grade of 80% or higher in Honors Pre-Calculus or Pre-Calculus CP

**Course Description:** Honors Calculus is an academic course that is intended for all advanced mathematics, engineering, and science students who want to further their fundamental knowledge of calculus. This course is designed for students to study: Limits, Derivatives, Trigonometric Functions, the Integral, and applications of these ideas in various scientific and mathematical real-world problems. District final exam is required.

**Suggested Grade Level**: Grade 12

**Length of Course:** Two Semesters

**Units of Credit:** 1

**PDE Certification and Staffing Policies and Guidelines (CSPG) Required Teacher Certifications:**

CSPG #50 Mathematics (7-12)

To find the CSPG information, go to [CSPG](https://www.education.pa.gov/Educators/Certification/Staffing%20Guidelines/Pages/default.aspx)

**Certification verified by the WCSD Human Resources Department:** [x] Yes [ ] No

**WCSD STUDENT DATA SYSTEM INFORMATION**

**Course Level:** Honors & Dual Enrollment (1) GPA +5%

**Mark Types:** Check all that apply.

[x] F – Final Average [x] MP – Marking Period [x] EXM – Final Exam

**GPA Type**: [ ]  GPAEL-GPA Elementary [ ]  GPAML-GPA for Middle Level [x]  NHS-National Honor Society

[x]  UGPA-Non-Weighted Grade Point Average [x]  GPA-Weighted Grade Point Average

**State Course Code**: 02121

To find the State Course Code, go to [State Course Code](https://nces.ed.gov/forum/sced.asp), download the Excel file for *SCED*, click on SCED 6.0 tab, and choose the correct code that corresponds with the course.

**TEXTBOOKS AND SUPPLEMENTAL MATERIALS**

**Board Approved Textbooks, Software, and Materials:**

**Title:**  *Calculus AP Edition with CalcChat and CalcView, 11e*

**Publisher:** Cengage Learning

**ISBN #:**  978-1-337-28688-6

**Copyright Date:** 2018

**WCSD Board Approval Date:** 6/29/2020

**Supplemental Materials:** College Board: AP Classroom, Khan Academy, Kuta Software, Brainfuse,
 SAS pdesas.org, Graphing Calculator: TI-89 Titanium,
 Online Calculator: Desmos

**Curriculum Document**

**WCSD Board Approval:**

**Date Finalized:** 5/23/2022

**Date Approved:**  6/13/2022

**Date(s) Revised:**  6/12/2023

**Implementation Year:** 2022-2023

**SPECIAL EDUCATION, 504, and GIFTED REQUIREMENTS**

The teacher shall make appropriate modifications to instruction and assessment based on a student’s Individual Education Plan (IEP), Chapter 15 Section 504 Plan (504), and/or Gifted Individual Education Plan (GIEP).

**SCOPE AND SEQUENCE OF CONTENT, AND CONCEPTS**

**Marking Period 1: Summer Preparation for Calculus, Limits and Their Properties, and Differentiation**

* Summer Preparation of Calculus (Review/Assessment)
	+ Graphs and Models
	+ Linear Models and Rates of Change
	+ Functions and Their Graphs
	+ Trigonometric Functions Review
* Limits Graphically and Numerically
* Analytical Evaluation of Limits
* Continuity and One-Sided Limits
* Infinite Limits
* Limits at Infinity
* The Derivative and the Tangent Line Problem
* Basic Differentiation Rules and Rates of Change
* **End of Marking Period 1**

**Marking Period 2: Differentiation, and Applications of Differentiation**

* The Product and Quotient Rules and Higher-Order Derivatives
* The Chain Rule
* Implicit Differentiation
* Related Rates
* Extrema on an Interval
* Rolle’s Theorem and the Mean Value Theorem
* Increasing and Decreasing Functions and the First Derivative Test
* Concavity and the Second Derivative Test
* **End of Marking Period 2**

**Marking Period 3: Applications of Differentiation, and Integration**

* Summary of Curve Sketching
* Optimization Problems
* Antiderivatives and Indefinite Integration
* Area
* Riemann Sums and Definite Integrals
* The Fundamental Theorem of Calculus
* Integration by Substitution
* Numerical Integration
* **End of Marking Period 3**

**Marking Period 4: Logarithmic, Exponential, and Other Transcendental Functions**

* The Natural Logarithmic Function and Differentiation
* The Natural Logarithmic Function and Integration
* Inverse Functions
* Exponential Functions: Differentiation and Integration
* Bases Other Than e and Applications
* Inverse Trigonometric Functions and Differentiation
* Inverse Trigonometric Functions: Integration and Completing the Square
* **Final Exam Review and Assessment**
	+ Limits and their Properties
	+ Differentiation
	+ Applications of Differentiation: Extrema on an Interval, Rolle’s Theorem,
	Mean Value Theorem, Increasing/Decreasing Functions, First Derivative Test,
	Concavity and the Second Derivative Test
	+ Applications of Differentiation: Summary of Curve Sketching,
	Optimization Problems
	+ Integration
	+ Logarithmic, Exponential and Other Transcendental Functions
* ***Optional, if time permits: Performance Indicators: Applications of Integration***
	+ *Area of a Region Between Two Curves*
	+ *Volume: The Disc Method*
	+ *Volume: The Washer Method*

**Standards/Eligible Content and Skills**

| **Performance Indicator** | **PA Core Standard and/or Eligible Content** | **Marking Period Taught**  |
| --- | --- | --- |
| Sketch the graph of an equation | CC.2.2.HS.D.7F-IF.7 | SP/MP1 |
| Find the intercepts of a graph | CC.2.2.HS.C.2F-IF.7 | SP/MP1 |
| Test a graph for symmetry with respect to an axis or the origin | CC.2.2.HS.C.2F-IF.7 | SP/MP1 |
| Find the points of intersection of two graphs | CC.2.2.HS.C.2F-IF.7 | SP/MP1 |
| Interpret mathematical models for real-world data | CC.2.2.HS.C.6CC.2.2.HS.D.10A-CED.3 | SP/MP1 |
| Find the slope of a line passing through two points | CC.2.2.HS.C.1 | SP/MP1 |
| Write the equation of a line with a given point and slope: Slope-Intercept Form, Point-Slope Form, Standard Form, General Form | A-CED.2 | SP/MP1 |
| Interpret slope as a ratio or as a rate in a real-world and mathematical application | A-SSE.1 | SP/MP1 |
| Sketch the graph of a linear equation in slope-intercept form | CC.2.2.HS.C.2F-IF.7 | SP/MP1 |
| Write equations of lines that are parallel or perpendicular to a given line | A-CED.2 | SP/MP1 |
| Use function notation to represent and evaluate a function | F-IF.2 | SP/MP1 |
| Find the domain and range of a function | F-IF.1 | SP/MP1 |
| Sketch the graph of a function | CC.2.2.HS.C.2F-IF.7 | SP/MP1 |
| Identify and complete different types of transformations of functions | CC.2.2.HS.C.4 | SP/MP1 |
| Classify functions and recognize combinations of functions | CC.2.2.HS.C.4 | SP/MP1 |
| Determine if a function is even, odd, or neither | F-BF.3F-IF.4 | SP/MP1 |
| Describe angles and use degree measure | G-CO.1 | SP/MP1 |
| Use radian measure | F-TF.1 | SP/MP1 |
| Find co-terminal angles of trigonometric functions | F-TF.4 | SP/MP1 |
| Understand the definitions of the six trigonometric functions | F-TF.2G-SRT.6 | SP/MP1 |
| Evaluate trigonometric functions | CC.2.2.HS.C.7 | SP/MP1 |
| Solve trigonometric equations | CC.2.2.HS.D.10 | SP/MP1 |
| Identify and graph trigonometric functions | CC.2.2.HS.C.8F-IF.7 | SP/MP1 |
| Use a TI-89 Titanium graphing calculator to evaluate trigonometric functions | CC.2.2.HS.C.8F-IF.7 | SP/MP1 |
| Estimate a limit using a numerical or graphical approach | CC.2.2.HS.C.6A-REI.11F-IF.4 | MP1 |
| Learn different ways that a line can fail to exist | A-SSE.1 | MP1 |
| Use a formal definition of a limit | A-SSE.1 | MP1 |
| Evaluate a limit using properties of limits | CC.2.2.HS.C.1CC.2.2.HS.C.6 | MP1 |
| Develop and use a strategy for finding limits | CC.2.2.HS.C.1 | MP1 |
| Evaluate a limit: Dividing Out Technique, Rationalizing Technique, Squeeze Theorem | CC.2.2.HS.C.1CC.2.2.HS.C.6 | MP1 |
| Determine continuity at a point and continuity on an open interval | CC.2.2.HS.D.7 | MP1 |
| Determine one-sided limits and continuity on a closed interval | CC.2.2.HS.D.7 | MP1 |
| Use properties of continuity | CC.2.2.HS.D.7 | MP1 |
| Understand and use the Intermediate Value Theorem | CC.2.2.HS.C.1 | MP1 |
| Determine infinite limits from the left and from the right | CC.2.2.HS.D.7F-IF.4 | MP1 |
| Find and sketch the vertical asymptotes of the graph of a function | CC.2.2.HS.D.7F-IF.4 | MP1 |
| Determine (finite) limits at infinity | CC.2.2.HS.D.7F-IF.4 | MP1 |
| Determine the horizontal asymptotes, if any, of the graph of a function | CC.2.2.HS.D.7F-IF.4 | MP1 |
| Determine infinite limits at infinity | CC.2.2.HS.D.7F-IF.4 | MP1 |
| Use a TI-89 Titanium graphing calculator to estimate limits, then find them analytically | CC.2.2.HS.C.1CC.2.2.HS.D.7F-IF.4 | MP1 |
| Find the slope of the tangent line to a curve at a point | CC.2.2.HS.C.1 | MP1 |
| Use the limit definition to find the derivative of a function | CC.2.2.HS.C.1F-IF.4 | MP1 |
| Understand the relationship between differentiability and continuity | CC.2.2.HS.C.1 | MP1 |
| Find the derivative of a function rule: Constant Rule, Power Rule, Constant Multiple Rule, Sum and Difference Rules | CC.2.2.HS.C.1 | MP1 |
| Find the derivatives of the sine function and of the cosine function | CC.2.2.HS.C.1 | MP1 |
| Use derivatives to find rates of change | CC.2.2.HS.C.1F-IF.6 | MP1 |
| **End of Marking Period 1** |  | **MP1** |
| Find the derivative of a function: Product Rule, Quotient Rule  | CC.2.2.HS.C.1 | MP2 |
| Find the derivative of a trigonometric function | CC.2.2.HS.C.6 | MP2 |
| Find a higher-order derivative of a function | CC.2.2.HS.C.1 | MP2 |
| Find the derivative of a composite function using the Chain Rule | CC.2.2.HS.C.1F-BF.1c | MP2 |
| Find the derivative of a function using the General Power Rule | CC.2.2.HS.C.1F-BF.1c | MP2 |
| Simplify the derivative of a function using algebra | CC.2.2.HS.C.1F-BF.1c | MP2 |
| Find the derivative of a trigonometric function using the Chain Rule | CC.2.2.HS.C.1F-BF.1c | MP2 |
| Distinguish between functions written in implicit form and explicit form | CC.2.2.HS.C.1F-BF.1c | MP2 |
| Use implicit differentiation to find the derivative of a function | CC.2.2.HS.C.1F-BF.1c | MP2 |
| Find a related rate | F-IF.6 | MP2 |
| Use related rates to solve real-life problems | F-IF.6 | MP2 |
| Understand the definition of extrema of a function on an interval | F-IF.4 | MP2 |
| Understand the definition of relative extrema of a function on an open interval | F-IF.4 | MP2 |
| Find extrema on a closed interval | F-IF.4 | MP2 |
| Understand and use Rolle’s Theorem | CC.2.2.HS.C.1 | MP2 |
| Understand and use the Mean Value Theorem | CC.2.2.HS.C.1 | MP2 |
| Determine intervals on which a function is increasing or decreasing | F-IF.4 | MP2 |
| Apply the First Derivative Test to find relative extrema of a function | CC.2.2.HS.C.1F-IF.4 | MP2 |
| Determine intervals on which a function is concave upward or concave downward | F-IF.4 | MP2 |
| Find any points of inflection of the graph of a function | F-IF.4 | MP2 |
| Apply the Second Derivative Test to find relative extrema of a function | CC.2.2.HS.C.1 | MP2 |
| **End of Marking Period 2** |  | **MP2** |
| Analyze and sketch the graph of a function on the TI-89 Titanium graphing calculator | CC.2.2.HS.C.2F-IF.4 F-IF.7 | MP3 |
| Solve applied minimum and maximum problems | CC.2.2.HS.C.1 | MP3 |
| Write the general solution of a differential equation and use indefinite integral notation for antiderivatives | CC.2.2.HS.C.6 | MP3 |
| Use basic integration rules to find antiderivatives | CC.2.2.HS.C.6 | MP3 |
| Find a particular solution of a differential equation | CC.2.2.HS.C.6 | MP3 |
| Use sigma notation to write and evaluate a sum | CC.2.2.HS.C.6 | MP3 |
| Understand the concept of area | CC.2.2.HS.C.2CC.2.3.HS.A.14 | MP3 |
| Approximate the area of a plane region | CC.2.3.HS.A.14A-REI.11 | MP3 |
| Find the area of a plane region using limits | CC.2.3.HS.A.14 | MP3 |
| Understand the definition of a Riemann Sum | CC.2.2.HS.C.1 | MP3 |
| Evaluate a definite integral using limits and geometric formulas | CC.2.2.HS.C.2CC.2.2.HS.C.4CC.2.3.HS.A.14 | MP3 |
| Evaluate a definite integral using properties of definite integrals | CC.2.2.HS.C.2CC.2.2.HS.C.4 | MP3 |
| Evaluate a definite integral using the Fundamental Theorem of Calculus | CC.2.2.HS.C.1CC.2.2.HS.C.2CC.2.2.HS.C.4 | MP3 |
| Understand and use the Mean Value Theorem of Integrals | CC.2.2.HS.C.1 | MP3 |
| Find the average value of a function over a closed interval | CC.2.2.HS.C.1 | MP3 |
| Understand and use the Second Fundamental Theorem of Calculus | CC.2.2.HS.C.1CC.2.2.HS.C.2CC.2.2.HS.C.4 | MP3 |
| Understand and use the Net Change Theorem | CC.2.2.HS.C.1 | MP3 |
| Use pattern recognition to find an indefinite integral | CC.2.2.HS.C.6 | MP3 |
| Use a change of variables to find an indefinite integral | CC.2.2.HS.C.6 | MP3 |
| Use the General Power Rule for Integration to find an indefinite integral | CC.2.2.HS.C.1 | MP3 |
| Use a change of variables to evaluate a definite integral | F-IF.2 | MP3 |
| Evaluate a definite integral involving an even or odd function | F-IF.2 | MP3 |
| Approximate a definite integral using the Trapezoidal Rule | CC.2.2.HS.C.1A-REI.11 | MP3 |
| Approximate a definite integral using Simpson’s Rule | CC.2.2.HS.C.1A-REI.11 | MP3 |
| Analyze the approximate errors: Trapezoidal Rule, Simpson’s Rule | CC.2.2.HS.C.1A-REI.11 | MP3 |
| **End of Marking Period 3** |  | **MP3** |
| Develop and use properties of the natural logarithmic function | CC.2.2.HS.C.1A-SSE.3c | MP4 |
| Understand the definition of the number e | A-SSE.3c | MP4 |
| Find derivatives of functions involving the natural logarithmic function | A-SSE.3c | MP4 |
| Use the Log Rule for Integration to integrate a rational function | CC.2.2.HS.C.1A-SSE.3c | MP4 |
| Integrate trigonometric functions | F-BF.1 F-TF.7 | MP4 |
| Verify that one function is the inverse function of another function | F-BF.4b | MP4 |
| Determine whether a function has an inverse function  | F-BF.4F-BF.4b | MP4 |
| Find the derivative of an inverse function | F-BF.4F-BF.4b | MP4 |
| Develop properties of the natural exponential function | F-BF.5A-SSE.3c | MP4 |
| Differentiate natural exponential functions | F-BF.5A-SSE.3c | MP4 |
| Integrate natural exponential functions | F-BF.5A-SSE.3c | MP4 |
| Define exponential functions that have bases other than e | F-LE.4A-SSE.3c | MP4 |
| Differentiate and integrate exponential functions that have bases other than e | F-LE.4A-SSE.3c | MP4 |
| Use exponential functions to model compound interest and exponential growth | F-IF.8b | MP4 |
| Develop properties of the six inverse trigonometric functions | F-TF.2 F-TF.3F-TF.4 | MP4 |
| Differentiate an inverse trigonometric function | F.BF.4F-TF.7 | MP4 |
| Review the basic differentiation rules for elementary functions | CC.2.2.HS.C.1 | MP4 |
| Integrate functions whose antiderivatives involve inverse trigonometric functions | F-BF.4F-TF.7  | MP4 |
| Use the method of completing the square to integrate a function | F-IF.8a | MP4 |
| Review the basic integration rules involving elementary functions | CC.2.2.HS.C.1 | MP4 |
| **Final Exam Review and Assessment** |  | **MP4** |
| * Review and demonstrate knowledge of Limits and their Properties
 |  | MP4 |
| * Review and demonstrate knowledge of Differentiation
 |  | MP4 |
| * Review and demonstrate knowledge of Applications of Differentiation: Extrema on an Interval, Rolle’s Theorem, Mean Value Theorem, Increasing/Decreasing Functions, First Derivative Test, Concavity and the Second Derivative Test
 |  | MP4 |
| * Review and demonstrate knowledge of Applications of Differentiation: Summary of Curve Sketching, Optimization Problems
 |  | MP4 |
| * Review and demonstrate knowledge of Integration
 |  | MP4 |
| * Review and demonstrate knowledge of Logarithmic, Exponential and Other Transcendental Functions
 |  | MP4 |
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| ***Optional, if time permits: Performance Indicators: Applications of Integration*** |  |  |
| *Find the area of a region between two curves using integration* | *CC.2.3.HS.A.14* | *MP4* |
| *Find the area of a region between intersecting curves using integration* | *CC.2.3.HS.A.14* | *MP4* |
| *Describe integration as an accumulation process* | *CC.2.2.HS.C.1* | *MP4* |
| *Find the volume of a solid revolution: Disc Method* | *CC.2.3.HS.A.13**CC.2.3.HS.A.14* | *MP4* |
| *Find the volume of a solid revolution: Washer Method* | *CC.2.3.HS.A.13**CC.2.3.HS.A.14* | *MP4* |

**ASSESSMENTS**

**PDE Academic Standards, Assessment Anchors, and Eligible Content:** The teacher must be knowledgeable of the PDE Academic Standards, Assessment Anchors, and Eligible Content and incorporate them regularly into planned instruction.

**Formative Assessments:** The teacher will utilize a variety of assessment methods to conduct in-process evaluations of student learning.

**Effective formative assessments for this course include:
Suggested but not limited to:**

* Pre-assessments of prior knowledge (e.g., Entrance cards or KWL chart)
* Bellringers/Problems of the Day (PODs)
* Discussions
* Exit ticket
* Teacher observations/Questioning
* Graphic organizers (e.g., Venn Diagrams, word mapping, webbing, KWL chart, etc.)
* Outlining
* Cooperative learning
* Written work
* Quizzes
* Oral response
* Self-evaluation
* Homework
* Summarizing
* Note-taking

**Summative Assessments:** The teacher will utilize a variety of assessment methods to evaluate student learning at the end of an instructional task, lesson, and/or unit.

**Effective summative assessments for this course include:
Suggested but not limited to:**

* Performance assessment
* Chapter/unit tests
* Quizzes
* Final exam
* Projects
* Student presentations