

## WARREN COUNTY SCHOOL DISTRICT

### PLANNED INSTRUCTION

#### **COURSE DESCRIPTION**

**Course Title:** Calculus Honors

**Course Number:** 00291

**Course Prerequisites:** Completion of Pre-Calculus Honors or Pre-Calculus CP with an average of 80% or above.

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

**Suggested Grade Level:** Grades 11-12

**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](#)

**Certification verified by the WCSD Human Resources Department:** ☒ Yes ☐ No

#### **WCSD STUDENT DATA SYSTEM INFORMATION**

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

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

☒ F – Final Average ☒ MP – Marking Period ☒ EXM – Final Exam

**GPA Type:** ☐ GPAEL-GPA Elementary ☐ GPAML-GPA for Middle Level ☒ NHS-National Honor Society

☒ UGPA-Non-Weighted Grade Point Average ☒ GPA-Weighted Grade Point Average

**State Course Code:** 02121

To find the State Course Code, go to [State Course Code](#), download the Excel file for SCED, click on SCED 6.0 tab, and choose the correct code that corresponds with the course.

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#### **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, pdesas.org, TI-89 Titanium Graphing Calculator

#### **Curriculum Document**

##### **WCSD Board Approval:**

**Date Finalized:** 5/23/2022  
**Date Approved:** 6/13/2022  
**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
- 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
- Mid-Term Review and Assessment

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

- A 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
- 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
  
- **Optional, if time permits: Performance Indicators: Applications of Integration**
  - *Area of a Region Between Two Curves*
  - *Volume: The Disc Method*
  - *Volume: The Shell Method*
  - *Arc Length*

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**Standards/Eligible Content and Skills**

<b>Performance Indicator</b>	<b>PA Core Standard and/or Eligible Content</b>	<b>Marking Period Taught</b>
Sketch the graph of an equation	CC.2.2.HS.D.7 F-IF.7	SP/MP1
Find the intercepts of a graph	CC.2.2.HS.C.2 F-IF.7	SP/MP1
Test a graph for symmetry with respect to an axis or the origin	CC.2.2.HS.C.2 F-IF.7	SP/MP1
Find the points of intersection of two graphs	CC.2.2.HS.C.2 F-IF.7	SP/MP1
Interpret mathematical models for real-world data	CC.2.2.HS.C.6 CC.2.2.HS.D.10	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      F-IF	SP/MP1
Sketch the graph of a linear equation in slope-intercept form	CC.2.2.HS.C.2 F-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.2 F-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		
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		
Understand the definitions of the six trigonometric functions	F-TF      G-SRT	SP/MP1
Evaluate trigonometric functions	F-TF	SP/MP1
Solve trigonometric equations	F-TF	SP/MP1
Identify and graph trigonometric functions	CC.2.2.HS.C.8 F-IF.7      F-TF	SP/MP1
Estimate a limit using a numerical or graphical approach	CC.2.2.HS.C.6 A-REI.11 F-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

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<b>Performance Indicator</b>	<b>PA Core Standard and/or Eligible Content</b>	<b>Marking Period Taught</b>
Evaluate a limit using properties of limits	CC.2.2.HS.C.1 F-IF	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.1 F-IF	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.7 F-IF.4	MP1
Find and sketch the vertical asymptotes of the graph of a function	CC.2.2.HS.D.7 F-IF.4	MP1
Determine (finite) limits at infinity	CC.2.2.HS.D.7 F-IF.4	MP1
Determine the horizontal asymptotes, if any, of the graph of a function	CC.2.2.HS.D.7 F-IF.4	MP1
Determine infinite limits at infinity	CC.2.2.HS.D.7 F-IF.4	MP1
Use a TI-89 Titanium graphing calculator to estimate limits, then find them analytically	CC.2.2.HS.C.1 F-IF	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.1 F-IF	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	F-TF	MP1
Use derivatives to find rates of change	CC.2.2.HS.C.1 F-IF	MP1
<b>Marking Period 1</b>		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	F-TF	MP2
Find a higher-order derivative of a function	F-TF	MP2
Find the derivative of a composite function using the Chain Rule	CC.2.2.HS.C.1 F-BF.1C	MP2
Find the derivative of a function using the General Power Rule	CC.2.2.HS.C.1 F-BF.1C	MP2

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<b>Performance Indicator</b>	<b>PA Core Standard and/or Eligible Content</b>	<b>Marking Period Taught</b>
Simplify the derivative of a function using algebra	CC.2.2.HS.C.1 F-BF.1C	MP2
Find the derivative of a trigonometric function using the Chain Rule	CC.2.2.HS.C.1 F-BF.1C	MP2
Distinguish between functions written in implicit form and explicit form	CC.2.2.HS.C.1 F-BF.1C	MP2
Use implicit differentiation to find the derivative of a function	CC.2.2.HS.C.1 F-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.1 F-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
<b>Mid-Term Review and Assessment</b>		MP2
<ul style="list-style-type: none"> <li>Review and extend knowledge of Limits and Their Properties</li> </ul>		MP2
<ul style="list-style-type: none"> <li>Review and extend knowledge of Differentiation</li> </ul>		MP2
<ul style="list-style-type: none"> <li>Review and extend 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</li> </ul>		MP2
Analyze and sketch the graph of a function on the TI-89 Titanium graphing calculator	CC.2.2.HS.C.2 F-IF.4 F-IF.7	MP3
Solve applied minimum and maximum problems	CC.2.2.HS.C.1 F-IF	MP3

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<b>Performance Indicator</b>	<b>PA Core Standard and/or Eligible Content</b>	<b>Marking Period Taught</b>
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.2 CC.2.3.HS.A.14	MP3
Approximate the area of a plane region	CC.2.3.HS.A.14 A-REI.11	MP3
Find the area of a plane region using limits	CC.2.3.HS.A.14 F-IF	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.2 CC.2.2.HS.C.4 CC.2.3.HS.A.14	MP3
Evaluate a definite integral using properties of definite integrals	CC.2.2.HS.C.2 CC.2.2.HS.C.4	MP3
Evaluate a definite integral using the Fundamental Theorem of Calculus	CC.2.2.HS.C.1 CC.2.2.HS.C.2 CC.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.1 CC.2.2.HS.C.2 CC.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	F-IF	MP3
Use a change of variables to find an indefinite integral	F-IF	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.1 A-REI.11	MP3
Approximate a definite integral using Simpson's Rule	CC.2.2.HS.C.1 A-REI.11	MP3
Analyze the approximate errors: Trapezoidal Rule, Simpson's Rule	CC.2.2.HS.C.1 A-REI.11	MP3
<b>Marking Period 3</b>		MP3
Develop and use properties of the natural logarithmic function	CC.2.2.HS.C.1 A-SSE.3C	MP4
Understand the definition of the number e	F-BF A-SSE.3C	MP4



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<b>Performance Indicator</b>	<b>PA Core Standard and/or Eligible Content</b>	<b>Marking Period Taught</b>
Find derivatives of functions involving the natural logarithmic function	F-BF A-SSE.3C	MP4
Use the Log Rule for Integration to integrate a rational function	CC.2.2.HS.C.1 F-BF A-SSE.3C	MP4
Integrate trigonometric functions	F-BF      F-TF	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	MP4
Find the derivative of an inverse function	F-BF	MP4
Develop properties of the natural exponential function	F-BF.5 A-SSE.3C	MP4
Differentiate natural exponential functions	F-BF.5 A-SSE.3C	MP4
Integrate natural exponential functions	F-BF.5 A-SSE.3C	MP4
Define exponential functions that have bases other than e	F-LE.4 A-SSE.3C	MP4
Differentiate and integrate exponential functions that have bases other than e	F-LE.4 A-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.3 F-TF.4	MP4
Differentiate an inverse trigonometric function	F.BF.4 F-TF	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-TF.7      F-BF.4	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
<b>Final Exam Review and Assessment</b>		MP4
<ul style="list-style-type: none"> <li>Review and extend knowledge of Applications of Differentiation: Summary of Curve Sketching, Optimization Problems</li> </ul>		MP4
<ul style="list-style-type: none"> <li>Review and extend knowledge of Integration</li> </ul>		MP4
<ul style="list-style-type: none"> <li>Review and extend knowledge of Logarithmic, Exponential, and Other Transcendental Functions</li> </ul>		MP4

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Performance Indicator	PA Core Standard and/or Eligible Content	Marking Period Taught
<b>Optional, if time permits:</b> <b>Performance Indicators: Applications of Integration</b>		
<i>Find the area of a region between two curves using integration</i>	CC.2.3.HS.A.14	MP4
<i>Find the area of a region between intersecting curves using integration</i>	CC.2.3.HS.A.14	MP4
<i>Describe integration as an accumulation process</i>	CC.2.2.HS.C.1	MP4
<i>Find the volume of a solid revolution:</i> <i>Disk Method, Washer Method</i>	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
<i>Find the volume of a solid with known cross sections</i>	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
<i>Find the volume of a solid revolution using the Shell Method</i>	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
<i>Compare the uses of the Disk Method and the Shell Method</i>	F-IF.9	MP4
<i>Find the arc length of a smooth curve</i>	G-MG	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
- Mid-Term exam
- Final exam
- Projects
- Student presentations