WARREN COUNTY SCHOOL DISTRICT

PLANNED INSTRUCTION

COURSE DESCRIPTION

Course Title: AP Calculus AB
Course Number: 00292
Course Prerequisites: Completion of Pre-Calculus Honors or Pre-Calculus CP with an average of 80% or above

Course Description: AP Calculus AB 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. Students taking this course are preparing for the option of taking AP Calculus Exam. 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: AP (1) GPA +10%
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: 02124
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.

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 Continuity, and Differentiation: Definition and Basic Derivative Rules

- Summer Preparation for Calculus (Review/Assessment)
  - o Graphs and Models
  - o Linear Models and Rates of Change
  - o Functions and Their Graphs
  - o Trigonometric Functions Review
- Limits Graphically and Numerically
- Evaluation of Limits Analytically
- Continuity and One-Sided Limits
- Infinite Limits
- Limits of Infinity
- The Derivative and the Tangent Line Problem
- Basic Differentiation Rules and Rates of Change
- Product and Quotient Rules and Higher Order Derivatives
- The Natural Logarithmic Function: Differentiation
- Exponential Functions: Differentiation, Integration
- Marking Period 1

Marking Period 2: Differentiation: Composite, Implicit, Inverse Functions, Contextual Application of Differentiation, and Analytical Applications of Differentiation

- The Chain Rule
- Implicit Differentiation
- Inverse Functions
- Inverse Trigonometric Functions: Differentiation
- Basic Differentiation Rules and Rates of Change
- Related Rates
- Differentials
- Indeterminate Forms and L'Hopital's Rule
- 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
- A Summary of Curve Sketching
- Optimization Problems
- Mid-Term Review and Assessment

Marking Period 3: Integration and Accumulation of Change, Differential Equations, and Applications of Integration: Average Value

- Antiderivatives
- Area
- Riemann Sums and Definite Integrals
- The Fundamental Theorem of Calculus: Accumulation Functions
- Integration by Substitution
- The Natural Logarithmic Function: Integration
- Differentials
- Exponential Functions: Differentiation, Integration
- Bases Other Than e and Applications
- Slope Fields and Euler's Method
- Separation of Variables and the Logistic Equation
- The Fundamental Theorem of Calculus: Average Value of Functions
- Marking Period 3

Marking Period 4: Applications of Integration: Area, Volume, and AP Preparation and Exam

- Area of a Region Between Two Curves
- Volume: The Disc and Washer Methods
- AP Calculus AB Preparation and Exam
    - Limits and Continuity
    - Differentiation: Definition and Basic Derivative Rules
    - Differentiation: Composite, Implicit, and Inverse Functions
    - Contextual Application of Differentiation
    - Analytical Applications of Differentiation
    - Integration and Accumulation of Change
    - Differential Equations
    - Applications of Integration
- Final Exam Review and Assessment
    - Integration and Accumulation of Change
    - Differential Equations
    - Applications of Integration

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PLANNED INSTRUCTION

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.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-life data	CC.2.2.HS.C.6 CC.2.2.HS.D.10 A-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	A-CED.2	SP/MP1
Interpret slope as a ratio or as a rate in a real-life application	CC.2.2.HS.C.6 A-SSE.1	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 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
Describe angles and use degree measure	G-CO.1	SP/MP1
Use radian measure	F-TF.1	SP/MP1
Understand the definitions of the six trigonometric functions	F-TF.2 G-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
Graph trigonometric functions	CC.2.2.HS.C.8 F-IF.7	SP/MP1
Define a limit	A-SSE.1	MP1
Use limit notation	A-SSE.1	MP1
Estimate limit values from graphs	CC.2.2.HS.C.6 A-REI.11 F-IF.4	MP1
Estimate limit values from tables	CC.2.2.HS.C.6 A-REI.11 F-IF.4	MP1
Determine limits using algebraic properties of limits	CC.2.2.HS.C.1 CC.2.2.HS.C.6	MP1

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Performance Indicator	PA Core Standard and/or Eligible Content	Marking Period Taught
Determine limits using algebraic manipulation	CC.2.2.HS.C.1 CC.2.2.HS.C.6	MP1
Select procedures for determining limits	CC.2.2.HS.C.1	MP1
Determine limits using the Squeeze Theorem	CC.2.2.HS.C.1 CC.2.2.HS.C.6	MP1
Connect multiple representations of limits	CC.2.2.HS.D.7	MP1
Explore different types of discontinuities	CC.2.2.HS.D.7	MP1
Define continuity at a point	CC.2.2.HS.D.7	MP1
Confirm continuity on an open interval	CC.2.2.HS.D.7	MP1
Remove discontinuities	CC.2.2.HS.D.7	MP1
Connect infinite limits and vertical asymptotes	CC.2.2.HS.D.7 F-IF.4	MP1
Connect limits at infinity and horizontal asymptotes	CC.2.2.HS.D.7 F-IF.4	MP1
Work with the Intermediate Value Theorem (IVT)	CC.2.2.HS.C.1	MP1
Define average and instantaneous rates of change at a point	CC.2.2.HS.C.1 F-IF.6	MP1
Define the derivative of a function	CC.2.2.HS.C.1 F-IF.2	MP1
Use the derivative function	CC.2.2.HS.C.1	MP1
Estimate derivatives of a function at a point	CC.2.2.HS.C.1 A-REI.11	MP1
Connect differentiability and continuity – when derivatives do and do not exist	CC.2.2.HS.C.1	MP1
Apply the Power Rule	CC.2.2.HS.C.1	MP1
Use the derivative rules: Constant, Sum, Difference, Constant, Multiple	CC.2.2.HS.C.1	MP1
Find the derivatives of cos x, sin x, e^x, and ln x	CC.2.2.HS.C.6	MP1
Use the Product Rule	CC.2.2.HS.C.1	MP1
Use the Quotient Rule	CC.2.2.HS.C.1	MP1
Find the derivative of tangent, cotangent, secant, and/or cosecant functions	CC.2.2.HS.C.6	MP1
Marking Period 1 - Ends		MP1
Use the Chain Rule	CC.2.2.HS.C.1 F-BF.1C	MP2
Use implicit differentiation	CC.2.2.HS.C.1 F-BF.1C	MP2
Differentiate inverse functions	F-BF.4	MP2
Differentiate inverse trigonometric functions	F-BF.4 F.TF.7	MP2
Select procedures for calculating derivatives	CC.2.2.HS.C.6	MP2
Calculate higher-order derivatives	CC.2.2.HS.C.1	MP2
Interpret the meaning of the derivative in context	CC.2.2.HS.C.1 CC.2.2.HS.C.6	MP2

Performance Indicator	PA Core Standard and/or Eligible Content	Marking Period Taught
Connect position, velocity, and acceleration – straight-line motion	F-IF.6	MP2
Use rates of change in applied context other than motion	F-IF.6	MP2
Set up related rates problems	F-IF.6	MP2
Solve related rates problems	F-IF.6	MP2
Approximate values of a functions using local linearity and linearization	CC.2.2.HS.C.1 A-REI.11	MP2
Use L'Hopital's Rule for determining limits of indeterminate forms	CC.2.2.HS.C.1	MP2
Use the Mean Value Theorem	CC.2.2.HS.C.1	MP2
Use the Extreme Value Theorem	CC.2.2.HS.C.1	MP2
Find global extrema, local extrema, and critical points	F-IF.4	MP2
Determine intervals on which a function is increasing or decreasing	F-IF.4	MP2
Use the First Derivative Test to determine relative/local extrema	CC.2.2.HS.C.1 F-IF.4	MP2
Use the Candidates Test to determine absolute/global extrema	CC.2.2.HS.C.1 F-IF.4	MP2
Determine concavity of functions over their domains	CC.2.2.HS.C.1 F-IF.4	MP2
Use the Second Derivative Test to determine extrema	CC.2.2.HS.C.1	MP2
Sketch graphs of functions and their derivatives	CC.2.2.HS.C.2 F-IF.7	MP2
Connect a function, first derivative, and a second derivative	CC.2.2.HS.C.5	MP2
Set up optimization problems	CC.2.2.HS.C.1	MP2
Solve optimization problems	CC.2.2.HS.C.1	MP2
Explore behaviors of implicit relations	F-IF.4	MP2
Mid-Term Review and Assessment		MP2
• Review and extend knowledge of Limits and Continuity		MP2
• Review and extend knowledge of Differentiation: Definitions and Basic Derivative Rules		MP2
• Review and extend knowledge of Differentiation: Composite, Implicit, Inverse Functions		MP2
• Review and extend knowledge of Contextual Application of Differentiation		MP2
• Review and extend knowledge of Analytical Applications of Differentiation		MP2
Explore accumulations of change	F-IF.6	MP3
Approximate Riemann Sums	CC.2.2.HS.C.1	MP3

Performance Indicator	PA Core Standard and/or Eligible Content	Marking Period Taught
Use Riemann Sums, summation notation, and definite integral notation	CC.2.2.HS.C.1 CC.2.2.HS.C.6	MP3
Use the Fundamental Theorem of Calculus with accumulation functions involving area	CC.2.2.HS.C.2 CC.2.3.HS.A.14	MP3
Interpret the behavior of accumulation functions involving area	CC.2.2.HS.C.2 CC.2.3.HS.A.14	MP3
Apply properties of definite integrals	CC.2.2.HS.C.2	MP3
Use the Fundamental Theorem of Calculus with definite integrals	CC.2.2.HS.C.4	MP3
Find the antiderivatives and indefinite integrals using basic rules and notation	CC.2.2.HS.C.6	MP3
Integrate using substitution	A-SSE.3	MP3
Integrate functions using long division and completing the square	A.APR.6 A-SSE.3 F-IF.8A	MP3
Select techniques for antidifferentiation	CC.2.2.HS.C.6	MP3
Model situations with differential equations	CC.2.2.HS.C.2	MP3
Verify solutions for differential equations	CC.2.2.HS.C.9	MP3
Sketch slope fields	CC.2.2.HS.C.5 F-IF.7	MP3
Reason using slope fields	CC.2.2.HS.D.9	MP3
Find general solutions using separation of variables	CC.2.2.HS.D.10	MP3
Find particular solutions using initial conditions and separation of variables	CC.2.2.HS.D.10	MP3
Model exponentials with differential equations	CC.2.2.HS.D.6 A-SSE.3C	MP3
Find the average value of a function on an interval	CC.2.2.HS.C.1	MP3
Connect position, velocity, and acceleration of functions using integrals	CC.2.2.HS.C.1	MP3
Use accumulation functions and definite integrals in applied contexts	CC.2.2.HS.C.1	MP3
Marking Period 3 - Ends		MP3
Find the area between curves expressed as functions of x	CC.2.3.HS.A.14	MP4
Find the area between curves expressed as functions of y	CC.2.3.HS.A.14	MP4
Find the area between curves that intersect at more than two points	CC.2.3.HS.A.14	MP4
Find the volume with cross sections of squares and rectangles	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
Find the volume with cross sections of triangles and semicircles	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4

Performance Indicator	PA Core Standard and/or Eligible Content	Marking Period Taught
Find the volume using the disc method revolving around x- or y-axis	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
Find the volume using the disc method revolving around other axes	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
Find the volume using the washer method revolving around the x- or y-axis	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
Find the volume using the washer method revolving around other axes	CC.2.3.HS.A.13 CC.2.3.HS.A.14	MP4
AP Exam Review and Exam		MP4
• Review and prepare knowledge of Limits and Continuity		MP4
• Review and prepare knowledge of Differentiation: Definition and Basic Derivative Rules		MP4
• Review and prepare knowledge of Differentiation: Composite, Implicit, Inverse Functions		MP4
• Review and prepare knowledge of Contextual Application of Differentiation		MP4
• Review and prepare knowledge of Analytical Applications of Differentiation		MP4
• Review and prepare knowledge of Integration and Accumulation of Change		MP4
• Review and prepare knowledge of Differential Equations		MP4
• Review and prepare knowledge of Applications of Integration		MP4
Final Exam Review and Assessment		MP4
• Review and extend knowledge of Integration and Accumulation of Change		MP4
• Review and extend knowledge of Differential Equations		MP4
• Review and extend knowledge of Applications of Integration		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