AP Calculus

Course Syllabus 2023-2024

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5th Period Planning

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Curricular Requirements

CR1   The students and teacher have access to a college-level calculus textbook, in print or electronic format.

CR2   The course is structured to incorporate the big ideas and required content outlined in each of the units described in the AP Course and Exam Description.

CR3   The course provides opportunities for students to develop the skills related to Mathematical Practice 1: Implementing Mathematical Processes.

CR4   The course provides opportunities for students to develop the skills related to Mathematical Practice 2: Connecting Representations.

CR5   The course provides opportunities for students to develop the skills related to Mathematical Practice 3: Justification.

CR6   The course provides opportunities for students to develop the skills related to Mathematical Practice 4: Communication and Notation.

CR7   Students have access to graphing calculators and opportunities to use them to solve problems and to explore and interpret calculus concepts.

CR8   The course provides opportunities for students to use calculus to solve real-world problems.

Course Overview

AP Calculus AB is equivalent to a first-semester college calculus course. Topics include functions, limits and continuity, derivatives, and integrals. The course will focus on applying the skills and concepts of calculus to modeling and solving problems across multiple representations.

Course Expectations

Students are expected to complete all homework problems to the best of their ability. If they need additional support, they can refer to the additional resources listed below.

The Personal Progress Checks (PPC) assigned online for this course through the student's College Board account are to be completed on time; exceptions will not be made.

Students will take daily quizzes. These quizzes are short and are intended to check for understanding concepts and skills recently taught. Students are required to make all corrections when the quizzes are returned to them.

All projects are due by the indicated due date.

<u>*Grading Policy*</u>

Summative Assessments (Tests) 40%	Unit Tests Quizzes
Formative Assessments (Primary classwork) 60%	Homework AP Classroom Progress Checks Classwork Daily Discussion
Midterm and Final 20% of the student's math average.	Semester 1 and Semester 2 exams

<u>*Supplies List*</u>

No. 2 Pencils

Loose Leaf Paper

Graphing Paper

One Inch Binder

Divider Tabs (set of 8)

Markers (8 colors)

Colored Pencils

Highlighters

Ruler

<u>*Technology Requirement*</u>

Students will be provided with a TI-NSpired graphing calculator. Some problems throughout the course will require them to use their graphing calculators.

<u>*Textbook Requirement*</u>

Finney, Demana, Waits, and Kennedy. *Calculus: Graphical, Numerical, Algebraic (AP Edition), 4th ed.* (Boston: Pearson Education, 2012)

<u>*Additional Resources*</u>

Students can watch a video on their Calculus Canvas page corresponding to the lesson we covered in class. Regularly, I send a video link to remind students of this resource.

- Students can log in to Khan Academy to find video lessons for the topic we are going over in class as well as practice problems.
- Students can log in to USA Testprep to find video lessons for the topic we are going over in class as well as practice problems.
- Students can come to me for help after school on Monday and Wednesday.

Course Outline and Pacing-Starting School August 7, 2023

- August/September - Unit 1
- October/November - Unit 2 and 3
- November/December - Unit 4
- January – Unit 5
- February – Unit 6
- March – Unit 7
- April – Unit 8
- May – AP Review

Student Practice

Throughout each unit, Topic Questions will be provided to help students check their understanding. The Topic Questions are especially useful for confirming understanding of difficult or foundational topics before moving on to new content or skills built on prior topics. Topic Questions can be assigned before, during, or after a lesson, and as in-class work or homework. Students will get rationales for each Topic Question that will help them understand why an answer is correct or incorrect, and their results will reveal misunderstandings to help them target the content and skills for additional practice.

At the end of each unit or at key points within a unit, PERSONAL PROGRESS CHECKS will be provided in class or as homework assignments in AP Classroom. Students will get a personal report with feedback on every topic, skill, and question that they can use to chart their progress, and their results will come with rationales that explain every question's answer. One to two class periods are set aside to re-teach skills based on the results of the Personal Progress Checks.

Course Outline and Description:

Unit 1: Polynomial and Rational Functions

1.1 Introducing Calculus: Can Change Occur at an Instant? (Skill 2.B)

1.2 Defining Limits and Using Limit Notation (Skill 2.B)

1.3 Estimating Limit Values from Graphs (Skill 2.B)

1.4 Estimating Limit Values from Tables (Skill 2.B)

1.5 Determining Limits Using Algebraic Properties of Limits (Skill 1.E)

1.6 Determining Limits Using Algebraic Manipulation (Skill 1.C)

1.7 Selecting Procedures for Determining Limits (Skill 1.C)

- Complete Personal Progress Check MCQ Part A for Unit 1

1.8 Determine Limits Using the Squeeze Theorem (Skill 3.C)

1.9 Connecting Multiple Representations of Limits (Skill 2.C)

1.10 Exploring Types of Discontinuities (Skill 3.B)

1.11 Defining Continuity at a Point (Skill 3.C)

- Complete Personal Progress Check MCQ Part B for Unit 1

1.12 Confirming Continuity over an Interval (Skill 1.E)

1.13 Removing Discontinuities (Skill 1.E)

1.14 Connecting Infinite Limits and Vertical Asymptotes (Skill 3.D)

1.15 Connecting Limits at Infinity and Horizontal Asymptotes (Skill 2.D)

- Complete Personal Progress Check FRQ A for Unit 1

1.16 Working with the Intermediate Value Theorem (Skill 3.E)

- Take Unit 1 Test

Unit 2: Differentiation: Definition and Fundamental Properties (Big Ideas: Change, Limits, Analysis of Functions)

2.1 Defining Average and Instantaneous Rates of Change at a Point (Skill 2.B)

2.2 Defining the Derivative of a Function and Using Derivative Notations (Skills 1.D and 4.C)

2.3 Estimating Derivative of a Function at a Point (Skill 1.E)

2.4 Connecting Differentiability and Continuity: Determining When Derivatives Do and Do Not Exist (Skill 3.E)

2.5 Applying the Power Rule (Skill 1.E)

- Complete Personal Progress Check MCQ A for Unit 2

2.6 Derivative Rules: Constant, Sum, Difference, and Constant Multiple (Skill 1.E)

2.7 Derivatives of cos x, sin x, e^x, and ln x (Skill 1.E)

2.8 The Product Rule (Skill 1.E)

2.9 The Quotient Rule (Skill 1.E)

- Complete Personal Progress Check FRQ A for Unit 2

2.10 Finding the Derivatives of Tangent, Cotangent, Secant, and/or Cosecant Functions (Skill 1.D)

- Complete Personal Progress Checks MCQ B and FRQ B for Unit 2
- Take Unit 2 Test

Unit 3: Differentiation: Composite, Implicit, and Inverse Functions (Big Ideas: Analysis of Functions)

3.1 The Chain Rule (Skill 1.C)

3.2 Implicit Differentiation (Skill 1.E)

3.3 Differentiating Inverse Functions (Skill 3.G)

3.4 Differentiating Inverse Trigonometric Functions (Skill 1.E)

- Complete Personal Progress Check FRQ B for Unit 3

3.5 Selecting Procedures for Calculating Derivatives (Skill 1.C)

3.6 Calculating Higher-Order Derivatives (Skill 1.E)

- Complete Personal Progress Checks MCQ and FRQ A for Unit 3
- Take Unit 3 Test

Unit 4: Contextual Applications of Differentiation (Big Ideas: Change, Limits)

4.1 Interpreting the Meaning of the Derivative in Context (Skill 1.D)

4.2 Straight-Line Motion: Connecting Position, Velocity, and Acceleration (Skill 1.E)

4.3 Rates of Change in Applied Contexts Other Than Motion (Skill 2.A)

4.4 Introduction to Related Rates (Skill 1.E)

4.5 Solving Related Rates Problems (Skill 3.F)

4.6 Approximating Values of a Function Using Local Linearity and Linearization (Skill 1.F)

- Complete Personal Progress Check FRQ A for Unit 4

4.7 Using L'Hospital's Rule for Determining Limits of Indeterminate Forms (Skill 3.D)

- Complete Personal Progress Checks MCQ and FRQ B for Unit 4
- Take Unit 4 Test

Unit 5: Analytical Applications of Differentiation (Big Ideas: Analysis of Functions)

5.1 Using the Mean Value Theorem (Skill 3.E)

5.2 Extreme Value Theorem, Global Versus Local Extrema, and Critical Points (Skill 3.E)

5.3 Determining Intervals on Which a Function is Increasing or Decreasing (Skill 2.E)

5.4 Using the First Derivative Test to Determine Relative (Local) Extrema (Skill 3.D)

- Complete Personal Progress Check MCQ A for Unit 5

5.5 Using the Candidates Test to Determine Absolute (Global) Extrema (Skill 1.E)

5.6 Determining Concavity of Functions over Their Domains (Skill 2.E)

- Complete Personal Progress Check FRQ A for Unit 5

5.7 Using the Second Derivative Test to Determine Extrema (Skill 3.D)

5.8 Sketching Graphs of Functions and Their Derivatives (Skill 2.D)

- Complete Personal Progress Check MCQ B for Unit 5

5.9 Connecting a Function, Its First Derivative, and Its Second Derivative (Skill 2.D)

5.10 Introduction to Optimization Problems (Skill 2.A)

5.11 Solving Optimization Problems (Skill 3.F)

5.12 Exploring Behaviors of Implicit Relations (Skill 1.E and 3.E)

- Complete Personal Progress Checks MCQ C and FRQ B for Unit 5
- Take Unit 5 Test

Unit 6: Integration and Accumulation of Change (Big Ideas: Change, Limits, Analysis of Functions)

6.1 Exploring Accumulations of Change (Skill 4.B)

6.2 Approximating Areas with Riemann Sums (Skill 1.F)

6.3 Riemann Sums, Summation Notation, and Definite Integral Notation (Skill 2.C)

- Complete Personal Progress Check FRQs B for Unit 6

6.4 The Fundamental Theorem of Calculus and Accumulation Functions (Skill 1.D)

6.5 Interpreting the Behavior of Accumulation Functions Involving Area (Skill 2.D)

6.6 Applying Properties of Definite Integrals (Skill 3.D)

- Complete Personal Progress Checks MCQ A for Unit 6

6.7 The Fundamental Theorem of Calculus and Definite Integrals (Skill 3.D)

6.8 Finding Antiderivatives and Indefinite Integrals: Basic Rules and Notation (Skill 4.C)

6.9 Integrating Using Substitution (Skill 1.E)

- Complete Personal Progress Check FRQs A for Unit 6

6.10 Integrating Functions Using Long Division and Completing the Square (Skill 1.E)

6.11 Selecting Techniques for Antidifferentiation (Skill 1.C)

- Complete Personal Progress Check MCQ B for Unit 6
- Take Unit 6 Test

Unit 7: Differential Equations (Big Ideas: Analysis of Functions)

7.1 Modeling Situations with Differential Equations (Skill 2.C)

7.2 Verifying Solutions for Differential Equations (Skill 3.G)

7.3 Sketching Slope Fields (Skill 2.C)

7.4 Reasoning Using Slope Fields (Skill 4.D)

7.5 Finding General Solutions Using Separation of Variables (Skill 1.E)

7.6 Finding Particular Solutions Using Initial Conditions and Separation of Variables (Skill 1.E)

- Complete Personal Progress Check FRQs A and B for Unit 7

7.7 Exponential Models with Differential Equations (Skill 3.G)

- Complete Personal Progress Check MCQ for Unit 7
- Take Unit 7 Test

Unit 8: Applications of Integration

8.1 Finding the Average Value of a Function on an Interval (Skill 1.E)

8.2 Connecting Position, Velocity, and Acceleration of Functions Using Integrals (Skill 1.D)

8.3 Using Accumulation Functions and Definite Integrals in Applied Contexts (Skill 3.D)

- Complete Personal Progress Check FRQ A for Unit 8

8.4 Finding the Area Between Curves Expressed as Functions of x (Skill 1.E)

8.5 Finding the Area Between Curves Expressed as Functions of y (Skill 1.E)

8.6 Finding the Area Between Curves at More Than Two Points (Skill 2.B)

- Complete Personal Progress Check MCQ A for Unit 8

8.7 Volumes with Cross Sections: Squares and Rectangles (Skill 3.D)

8.8 Volumes with Cross Sections: Triangles and Semicircles (Skill 3.D)

8.9 Volume with Disc Method: Around the x- or y-Axis (Skill 3.D)

8.10 Volume with Disc Method: Revolving Around Other Axes (Skill 2.D)

8.11 Volume with Washer Method: Revolving Around the x- or y-Axis (Skill 4.E)

8.12 Volume with Washer Method: Revolving Around Other Axes (Skill 2.D)

- Complete Personal Progress Check MCQ B for Unit 8
- Take Unit 8 Test

Application of Calculus Project:

Students will complete a project pertaining to optimization. Students will produce a product that they want to manufacture and decide on how much of that product they want to package and sell. Students will provide in detail how much it will cost for them to manufacture and package their product. Then, students will use calculus to determine the dimensions of their packaging that will determine the least amount of material used to package their product. Finally, students will use all their information to determine how much they should sell their product for to make their desirable profit.