

Wilson Area School District Planned Course Guide

Title of planned course: AP Calculus BC

Subject Area: Math

Grade Level: 12

Course Description: AP Calculus BC focus on students' understanding of calculus concepts and provide experience with methods and applications. Through the use of big ideas of calculus (e.g., modeling change, approximation and limits, and analysis of functions), this course is an extension of AP Calculus AB and becomes a cohesive whole, rather than a collection of unrelated topics. AP Calculus BC is designed to be the equivalent to both first and second semester college calculus courses. AP Calculus BC applies the content and skills learned in AP Calculus AB to parametrically defined curves, polar curves, and vector-valued functions; develops additional integration techniques and applications; and introduces the topics of sequences and series. This course will require students to use definitions and theorems to build arguments and justify conclusions. The course features a multirepresentational approach to calculus, with concepts, results, and problems expressed graphically, numerically, analytically, and verbally. Exploring connections among these representations builds understanding of how calculus applies limits to develop important ideas, definitions, formulas, and theorems. A sustained emphasis on clear communication of methods, reasoning, justifications, and conclusions is essential. Teachers and students will regularly use technology to reinforce relationships among functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

Time/Credit for this Course: Full Year / 1 Credit

Curriculum Writing Committee: Kimberly Kauffman

Wilson Area School District Planned Course Materials

Course Title: AP Calculus BC

Textbook: Finney/Demana/Waits/Kennedy, Calculus: Graphical, Numerical, Algebraic 4th Edition, AP* Edition ©2012

Supplemental Books: AP Calculus BC test prep books

Teacher Resources:

- College Board
- Korpis World
- Master Math Mentor
- Kahn Academy

Curriculum Map

- August:** Review of AP Calculus BC
- September:** Euler's Method
Integration By Parts
Integration with Fractional Decomposition
Logistic Growth
- October:** Arc Length
Improper Integrals
Differentiation of Parametric Equations
Arc Length of Parametric Equations
Differentiation of Vector-Valued Functions
Integration of Vector-Valued Functions
Motion Using Parametric and Vector-Valued Functions
- November:** Rectangular to Polar
Defining Polar Coordinates
Derivatives of Polar Functions
Graphing Polar Functions
- December:** Area of a Polar Functions
Area between Two Polar Functions
Review of AP Calculus AB material
- January:** Sequences
Series Convergence or Divergence
Geometric Series
Convergence or Divergence Tests
- February:** Alternating Series Error Bound
Taylor Polynomials
Lagrange Error Bound
- March:** Radius and Interval of Convergence for Power Series
Finding Taylor or Maclaurin Series for a Functions
Representing Functions as Power Series
- April:** Review for AP Exam
- May:** AP Exam
AP Calculus BC Music Video or Video Lesson
- June:** AP Calculus BC Music Video or Video Lesson

Curriculum Scope & Sequence

Planned Course: AP Calculus BC

Unit: Integration and Accumulation of Change

Time frame: 3 weeks

Anchor(s) or adopted anchor: FUN-6.E.1, FUN-6.F.1, LIM-6.A.1, LIM-6.A.2

Essential content/objectives: At the end of the unit, students will be able to:

- Use integration by parts to determine indefinite and definite integrals
- Use linear partial fractions to determine indefinite and definite integrals
- Evaluate an improper integral or determine if an improper integral diverges

Core Activities: Students will complete/participate in the following:

- Reviewing notes on a nightly basis
- Completing problem sets
- AP study guide assignments
- Personal Progress Check #6

Instructional Methods:

- Direct Instruction
- Group Work
- Independent Work

Materials & Resources:

- College Board
- Textbook
- Korpis World
- Kahn Academy

Assessments:

- In-class Q&A
- Self assessments
- Problem sets
- Test

Curriculum Scope & Sequence

Planned Course: AP Calculus BC

Unit: Differential Equations

Time frame: 2 weeks

Anchor(s) or adopted anchor: FUN-7.C.4, FUN-7.H.1, FUN-7.H.2, FUN-7.H.3,
FUN-7.H.4

Essential content/objectives: At the end of the unit, students will be able to:

- Use Euler's method to approximate a solution to a differential equation or a point on a solution curve
- Use the logistic growth mode
- Interpret the logistical differential equation and initial equations without solving
- Find the limiting capacity of a logistic growth model
- Find the value where a logistic growth model is changing the fastest

Core Activities: Students will complete/participate in the following:

- Reviewing notes on a nightly basis
- Completing problem sets
- AP study guide assignments
- Personal Progress Check #7

Instructional Methods:

- Direct Instruction
- Group Work
- Independent Work

Materials & Resources:

- College Board
- Textbook
- Korpis World
- Kahn Academy

Assessments:

- In-class Q&A
- Self assessments
- Problem sets
- Test

Curriculum Scope & Sequence

Planned Course: AP Calculus BC

Unit: Applications of Integration

Time frame: 2 – 3 days

Anchor(s) or adopted anchor: CHA-6.A.1

Essential content/objectives: At the end of the unit, students will be able to:

- Find the length of a planar curve by calculating a definite integral

Core Activities: Students will complete/participate in the following:

- Reviewing notes on a nightly basis
- Completing problems sets
- AP study guide assignments
- Personal Progress Check #8

Instructional Methods:

- Direct Instruction
- Group Work
- Independent Work

Materials & Resources:

- College Board
- Textbook
- Korpis World
- Kahn Academy

Assessments:

- In-class Q&A
- Self assessments
- Problem sets

Curriculum Scope & Sequence

Planned Course: AP Calculus BC

Unit: Parametric Equations, Polar Coordinates and Vector-Valued Functions

Time frame: 5-7 weeks

Anchor(s) or adopted anchor: CHA-3.G.1, CHA-3.G.2, CHA-3.G.3, CHA-6.B.1, CHA-3.H.1, FUN-8.A.1, FUN-8.B.1, FUN-8.B.2, FUN-3.G.1, FUN-3.G.2, CHA-5.D.1, CHA-5.D.2

Essential content/objectives: At the end of the unit, students will be able to:

- Find the derivative of a parametric curve
- Use a definite integral to find the arc length of a parametric curve
- Find the derivative of a vector-valued function
- Determine a particular solution given a rate vector and initial condition
- Determine velocity, speed and acceleration of a parametric or vector-valued function
- Find the displacement of a particle in planar motion
- Find the derivative of a polar function
- Calculate the area of a polar curve
- Find the area of a region bounded by two polar curves

Core Activities: Students will complete/participate in the following:

- Reviewing notes on a nightly basis
- Completing problem sets
- AP study guide assignments
- Personal Progress Check #9

Instructional Methods:

- Direct Instruction
- Group Work
- Independent Work

Materials & Resources:

- College Board
- Textbook
- Korpis World
- Kahn Academy

Assessments:

- In-class Q&A
- Self assessments
- Problem sets
- Test

Curriculum Scope & Sequence

Planned Course: AP Calculus BC

Unit: Infinite Sequences and Series

Time frame: 6-9 weeks

Anchor(s) or adopted anchor: LIM-7.A.1, LIM-7.A.2, LIM-7.A.3, LIM-7.A.4, LIM-7.A.5, LIM-7.A.6, LIM-7.A.7, LIM-7.A.8, LIM-7.A.9, LIM-7.A.10, LIM-7.A.11, LIM-7.A.12, LIM-7.A.13, LIM-7.A.14, LIM-7.B.1, LIM-8.A.1, LIM-8.B.1, LIM-8.C.1, LIM-8.C.2

Essential content/objectives: At the end of the unit, students will be able to:

- Determine whether a series converges or diverges
- Find the sum for which a series converges to
- Identify the constant ratio between terms in a geometric series
- Find the sum of a convergent geometric series
- Use the n-th term test for divergence
- Use the integral test to determine if a series converges or diverges
- Identify common series such as the harmonic series, the alternating harmonic series and a p-series
- Use the limit comparison test to determine if a series converges or diverges
- Use the alternating series test to determine if an alternating series converges
- Use the ratio test to determine if a series converges or diverges
- Determine if a series converges absolutely or conditionally
- Apply the alternating series bound to a convergent alternating series
- Write a nth degree Taylor polynomial for a function centered at $x = c$
- Use a nth degree Taylor polynomial to approximate the function near $x = a$
- Use Lagrange error bound to determine the maximum interval for the error of a Taylor polynomial approximation to a function

Core Activities: Students will complete/participate in the following:

- Reviewing notes on a nightly basis
- Completing problem sets
- AP study guide assignments
- Personal Progress Check #10

Instructional Methods:

- Direct Instruction
- Group Work
- Independent Work

Materials & Resources:

- College Board
- Textbook
- Korpis World
- Kahn Academy
- Goldstein (chapter 8)

Assessments:

- In-class Q&A
- Self assessments
- Problem sets
- Test