Calculus BC Course Syllabus

James I. O'Neill High School
2019-2020

Course Overview:

This is a college-level calculus course designed to meet the Advanced Placement curricular requirements for Calculus BC (equivalent to one year of college calculus). The major topics of this course are limits, derivatives, integrals, the Fundamental Theorem of Calculus, and series. We will investigate and analyze course topics using equations, graphs, tables, and words, with a particular emphasis on a conceptual understanding of calculus. Applications, in particular to solid geometry and physics, will be studied where appropriate.

Primary Textbook:

Finney, Demana, Waits, Kennedy.*Calculus: Graphical, Numerical, Algebraic.* 3rd ed. Boston: Pearson Prentice Hall, 1007.
You may sign out a copy for the year.

Graphing Calculators:

Each student is encouraged to get their own graphing calculator, TI-84 calculators will be available when in class but these can not leave the classroom. You will need access to a graphing calculator outside of the classroom.

Additional Resources:

Our Google Classroom contains PDF files of all notes and handouts. There are also sections with links to online applications, study guides, videos, and AP review resources.
Classroom Code- 1h77kc

Grading:

Labs- 25%
    4-5 per semester, Lab requirements will be outlined upon assignment
Homework- 25%
    No late HW accepted, weekly grades given.
Quizzes- 25%
    Shorter assessments on specific skills/topics. 10+ per semester
Exams- 25%
    Longer assessment on entire units. 2-3 per semester

Course Outline:

Prerequisites for Calculus- *Summer Assignment*

- 0.1 Functions and Graphs
- 0.2 Exponential Functions
- 0.3 Parametric Equations
- 0.5 Functions and Logarithms
- 0.6 Trigonometric Functions

Unit 1- Limits and Continuity *(13-14 days)*

- 1.1 Rates of Change and Limits
- 1.2 Limits Involving Infinity
- 1.3 Continuity
- 1.4 Rates of Change and Tangent Lines

Unit 1 Sample Activity-

Points of (dis)continuity: Students explore limits at discontinuities in four ways: first, using the table feature on their calculators with decreasing increments; second, using algebraic techniques to "simplify" the expressions given as formulas; third, using the graph trace feature on their calculators; and fourth, using descriptions of functions written in words to create graphs that match the verbal descriptions. Student work for the activity includes a written summary, using complete sentences, of their findings that compares and contrasts jump, removable, and asymptotic discontinuities.

Unit 2/3- Derivatives *(17-19 days)*

- 2.1 Derivative of a Function
- 2.2 Differentiability
- 2.3 Rules for Differentiation- *Summer Assignment*
- 2.4 Velocity and Other Rates of Change
- 2.5 Derivatives of Trigonometric Functions- *Summer Assignment*
- 2.6 Chain Rule
- 2.7 Implicit Differentiation
- 2.8 Derivatives of Inverse Trigonometric Functions
- 2.9 Derivatives of Exponential and Logarithmic Functions

Unit 4/5- Applications of Derivatives *(16-18 days)*

- 4.1 Extreme Values of Functions
- 4.2 Mean Value Theorem
- 4.3 Connecting f, f' and f" and with the Graph of f.
- 4.4 Modeling and Optimization
- *4.5 Linearization and Differentials*
- 4.6 Related Rates

Unit 5 Sample Activities-

Search for f: Using the graph of the derivative f ', students determine key features of f such as increasing/decreasing intervals, local extrema, points of inflection, and concavity intervals) and create a graph of f.

Mean Value Theorem: Students are asked to explain the conclusions of the MVT in writing for multiple scenarios in context.

Unit 6- The Definite Integral (*15-16 days)*

- 6.1 Estimating with Finite Sums
- 6.1 Definite Integrals
- 6.3 Definite Integrals and Antiderivatives
- 6.4 Fundamental Theorem of Calculus – Parts I and II
- 6.5 Trapezoidal Rule

Unit 6 Sample Activities-

Fundamental Theorem of Calculus; Consider the finite region in the first quadrant bounded by the curves f(x) = 4x and f(x) = x^4 *. Write a limit of a right-hand Riemann sum equal to the area of this region. Then use the Fundamental Theorem of Calculus to compute the area.*

Unit 7- Differential equations and Mathematical Modeling (*9-10 days)*

- 7.1 Slope Fields and Euler's Method
- 7.1 Antidifferentiation by Substitution
- 7.3 Antidifferentiation by Parts
- 7.4 Exponential Growth and Decay
- 7.5 Logistic Growth

Unit 8 Applications of Definite Integrals (*11-14 days)*

- 8.1 Integral as Net Change
- 8.1 Areas in the Plane
- 8.3 Volumes
- 8.4 Lengths of Curves
- 8.5 Applications from Science and Statistics

Unit 9- Sequences, L'Hopital's Rule, and Improper Integrals *(10-11 days)*

- 9.1 Sequences
- 9.1 L'Hospital's Rule
- 9.3 Relative Rates of Growth
- 9.4 Improper Integrals

Unit 10- Infinite Series *(17-18 days)*

- 10.1 Power Series
- 10.1 Taylor Series
- 10..3 Taylor's Theorem
- 10.4 Radius of Convergence
- 10.5 Testing Convergence at Endpoints

Unit 11- Parametric, Vector, and Polar Functions *(10-11 days)*

- 11.1 Parametric Functions
- 11.1 Vectors in the Plane
- 11.3 Polar Functions

AP Review:

Review for the AP test is ongoing throughout the year. Past multiple choice and free response problems are regularly used for in class warm-ups. Problem sets centered on particular themes and written in AP style are used at least twice in each chapter. I expect everyone to take part in addition review for the AP exam. Come to expanded day to discuss additional resources.