



# Calculus

Grade 12

## Course overview

The Calculus curriculum will prepare students for the AP Calculus AB Assessment. The course will emphasize the Rule of Four approach to mathematical education. There are a variety of ways to approach and solve problems. We will focus on the four branches of the problem-solving tree of mathematics:

- Numerical analysis  
*where data points are known, but not an equation*
- Graphical analysis  
*where a graph is known, but again, not an equation*
- Analytic/algebraic analysis  
*traditional equation and variable manipulation*
- Verbal/written methods of representing problems

## Course objectives

The Shelter Island High School Calculus course is designed for those students who will be taking the AP Calculus AB exam in May and will be going on to a Calculus course in college. It will expound on many of the topics you studied in Math to date as well as some new topics. The coursework is challenging. One of the keys to success is doing your homework. If you have problems understanding a topic you need to see Mr. Brigham right away, because much of the new work depends on understanding of the older work.

You will also be experiencing a new way of working using technology. We will work together to best utilize this technology.

## Technology Goals

We will use the calculator and other technologies in a variety of ways including:

- Conduct explorations.
- Graph functions within arbitrary windows.
- Solve equations numerically.
- Analyze and interpret results.
- Justify and explain results of graphs and equations

## Course Prerequisites

Algebra, Geometry, Alg II and Trig, Precalculus

## Materials Needed

- 2 3-Ring Binders
- Multi-color pens or pencils
- Graphing Calculator

## Mr. Brigham

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## Class Resources

All class resources are available to students in their google drive account. Public access to the textbook and homework videos are accessible on *Mr. Brigham's webpage* on the *Shelter Island School Website*. All assignments, upcoming assessments and class events are delivered daily to students directly via phone and email with the *Remind101* service

## Missing Work

If you have an unscheduled absence from class (sick, family emergency), for every day you are absent, you have that many days to make up your work. For example, if you are sick for two days, your missing work is due in two days. For a scheduled absence (school trip, sports, family vacation) your work is due upon your return to school. As mature young adults, responsibility is one of the most important characteristics to learn. It is your responsibility to find out which work you have missed. You may ask Mr. Brigham or any other member of the class. You as the student are responsible to turn in work after an absence and to set up a time to go over material you do not understand.

## Extra Help

Be sure to get extra help when you need it!!! Extra help is available Mon-Thurs from 2:30 to 3:00 or by appointment (Lunch, free period, or we can set up a phone appointment at night, text, facetime, skype, teamviewer, etc..) My numbers are 765 8700 and 49 49 49 8. Feel free to call me from 5am to 6:30 am or from 5pm until 8pm. My family goes to bed early, and wakes up early, so try not to call after 8.

## Grading

All homework must be completed. A missing homework will count as a zero in the homework average for the quarter.

Assessment Weights:

*Quiz, Tests, and Projects Average are 70% of Quarter Grade*

- Take home quiz - weighted .5x
- In class quiz/Project/SBQ - weighted 1x
- Test - weighted 2x

*Homework Grade Average 30% of Quarter Grade*

- Formative homework is checked for completion and assigned a grade of 0,50,75, or 100
- Summative HW is graded on a 0-100 scale and are always announced
- Missing HW counts as 0 in HW average

*Participation Grade (0,1,2) will be stored in Powerschool*

## Limits and Continuity

5 Weeks

- Rates of change *1 session*
- Limits at a point
  - Properties of limits *2 sessions*
  - Two-sided *3 sessions*
  - One-sided *1.5 sessions*
- Limits involving infinity
  - Asymptotic behavior *1 session*
  - End behavior *2 sessions*
  - Properties of limits *2 sessions*
  - Visualizing limits *2 sessions*
- Continuity
  - Continuous and Discontinuous functions *2 sessions*
  - Removable and Jump Discontinuity *2 sessions*
  - Infinite discontinuity *2 sessions*
- Instantaneous rates of change
  - Average vs Instantaneous ROC *3 sessions*
  - Estimating Instantaneous ROC *1.5 sessions*

## The Derivative

6 Weeks

- Define the Derivative *2 sessions*
- Differentiability
  - Local linearity *1 sessions*
  - Numeric derivatives using the calculator *1 sessions*
  - Differentiability vs continuity *3 sessions*
- Derivatives of algebraic functions *3 sessions*
- Applications to velocity and acceleration *3 sessions*
- Product Rule *2 sessions*
- Quotient Rule *2 sessions*
- Derivatives of trigonometric functions *2 sessions*
- The chain rule *3 sessions*
- Implicit derivatives
  - Differential method *2 sessions*
  - $y'$  method *2 sessions*
- Derivatives of inverse trigonometric functions *2 sessions*
- Derivatives of logarithmic and exponential functions *2 sessions*

## Application Of the Derivative

8 Weeks

- Extreme values
  - Local (relative) extrema *2 sessions*
  - Global (absolute) extrema *2 sessions*
- Using the derivative *2 sessions*
  - Mean value theorem *3 sessions*
  - Rolle's theorem *3 sessions*
  - Increasing and decreasing functions *2 sessions*
- Analysis of graphs using the first and second derivatives *4 sessions*
  - Critical values *2 sessions*
  - First derivative test for extrema *2 sessions*
  - Concavity and POIs *2 sessions*
  - 2nd derivative test for extrema *2 sessions*
- Optimization problems *3 sessions*
- Linearization models *2 sessions*
- Related rates *3 sessions*
- L'Hospital's Rule *4 sessions*

## The Definite Integral

4 Weeks

- Area Under a Curve
  - Riemann sums *2 sessions*
  - Trapezoidal rule *2 sessions*
  - Definite integrals *6 sessions*
- The Fundamental Theorem of Calculus (part 1) *2 sessions*
- Definite integrals and antiderivatives *2 sessions*
  - The Mean Value Theorem *2 sessions*
- The Fundamental Theorem of Calculus (part 2) *4 sessions*

## Differential Equations and Mathematical Modeling

3 Weeks

- Antiderivatives *3 sessions*
- Integration using u-du substitution *4 sessions*
- Separable differential equations *1 session*
  - Growth and decay *3 sessions*
  - Slope fields *2 sessions*
  - General differential equations *2 sessions*

## Applications of Definite Integrals

3 Weeks

- Applications of Definite Integrals *2 sessions*
- Summing rates of change *2 sessions*
- Particle motion *2 sessions*
- Areas in the plane *3 sessions*
- Volumes
  - Volumes of solids with known cross sections *3 sessions*
  - Volumes of solids of revolution *4 sessions*

## AP Exam Preparation and Review

8 Weeks

- Review of All Concepts *4 sessions*
- Analysis of AP Style Problems *2 sessions*
- Multiple Choice No Calculator *10 sessions*
- Multiple Choice Calculator *9 sessions*
- Free Response No Calculator *10 sessions*
- Free Response Calculator *9 sessions*
- Practice Exam *6 sessions*

## Post AP Test Projects

3 Weeks

- Research of History of Calculus *6 sessions*
- Calculus Debate *2 sessions*
- Sample of AP Calculus BC Topics *4 sessions*
- Technology Tips For College *3 sessions*

**Note:** All topic timetables are approximate.