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Course: Calculus AB/BC & IB Math HL Year 1
Book: Finney, Demana, Waits, Kennedy

I want to take this opportunity to inform you of what you will be doing in this class. The purpose of high school math is to prepare students to use math in a business or industrial setting and develop problem solving skills. We will hit the topic of problem solving hard because it is important to think and apply what is learned to real world situations.

Materials - You are expected to have a pencil, textbook, a calculator, a spiral notebook, and a folder in class every day. Your spiral notebook should be very large and dedicated exclusively to math. It is expected that your book will be covered. Students must have a graphing calculator such as a TI–83, TI-84, or TI-86, or TI-89 for use in this class. Much of the course is impossible without the use of a graphing calculator and the AP exam requires the use of a graphing calculator on ½ of the exam. If you come to class without your materials and you need to go to your locker, it will count as a tardy.

Office Hours – My office hours will be on Tuesdays from 2:50 – 3:20. Office hours is time that that is set aside for teachers to meet with students and/or parents. I will be available by appointment at additional times as needed. Contact me to schedule a meeting time.

Hall Passes - I will be conducting this class like a college course and treating you like adults. Adults do not ask to go to the bathroom. If you need to go to the bathroom, grab the hall pass and go. Please choose an appropriate time to do this so that it does not interrupt instruction and that you do not miss something important. Please self-monitor appropriately or else I will have to reconsider whether you should be treated like an adult.

Expectations

1. Follow directions
2. Be in your seat with your materials and ready to begin class when the bell rings
3. One person talks at a time. Raise your hand to get your chance to talk.
4. No put downs or inappropriate language
5. Be respectful of others and their property
6. Be responsible for yourself
7. Remain in your seat at the end of class until the teacher dismisses you
8. No talking during announcements
9. No food or beverage in class. Water will be allowed.
10. No cell phones, walkmans, or video games in class*

Behavior that is not in accordance with these expectations or that is not conducive to a safe and constructive learning atmosphere can result in any of the following consequences: 1.) conference with student, 2.) after school detention, 3.) removal from class, referral to Assistant Principal, and conference with parent or guardian. Severe behavior will result in immediate removal from class. At the end of the quarter, if you have any unserved detentions, you will receive an incomplete in the course until you have made up your obligations.

Grading Policy

This is how grades will be calculated:

Quizzes and Tests	80%
Homework	15%
Notes	5%

Students will be guaranteed the following grades if they achieve this percentage of the total points.

90 - 100 %	A
80 - 89 %	B
70 - 79 %	C
60 – 69 %	D
0 - 59 %	F

Homework - Homework is an essential part of this math course. You will have a homework assignment almost every day. These assignments will be checked and graded daily. Every assignment is worth 10 points. Since homework provides you with your first opportunity to practice, it is expected that you will make mistakes. Because of this, I will accept assignment for full credit up to the unit test date to give you the opportunity to continue working on problems that you initially had difficulty with and to give you time to seek advice and help on such questions . ***Assignments turned in after test day will not receive credit.*** Assignments with no work will receive no credit. I will post answer keys to all assignments on the class website so it will be your responsibility to correct your assignments at home prior to coming to class. If you do not have internet access at home, I can make copies of the answer keys for you. If you turn in your assignment and it has not been corrected, then I will assume that half of the problems are wrong and you will receive half credit. I will not correct them for you. Falling behind in homework will strongly affect your grade. Not only will you lose credit on daily work but it will also be difficult to master the topics and pass the tests.

***Hand-Held Electronic Devices** – Hand held devices used to connect to the internet such as an i-pod touch, i-phone, or blackberry can be used during work time to display the solutions manual so that you can check your work as you go and so that you can ask more specific questions. If you are using your hand held device to check your e-mail, play video games, listen to music, text, make phone calls, or surf the web, you will lose your privilege to use a hand held device in class. Please self-monitor appropriately or else I will have to reconsider whether you should be treated like an adult.

Attendance - Good attendance is critical for success in high school. By missing class, you will miss instruction and will have difficulty completing assignments and passing tests. Some of the requirements are based on group activities which take place during class time and may not be able to be made up outside of class. You are expected to be in class every day on time. Making up work due to an excused absence is your responsibility. This cannot interrupt class time, the teacher, or other students. Generally, a student has 2 days to make up work for each day of excused absence. Missing work resulting from an unexcused absence will not be accepted for credit. Following an absence, it is your responsibility to correct your assignment. If you turn in your assignment and it has not been corrected by someone, then you will receive half credit. Champlin Park has an attendance policy that states if you are truant from class 4 or more times in one quarter, you will not receive credit for that class. Also, you will only be allowed to be tardy 3 times per quarter. Every tardy after 3 will result in a detention. At the end of the quarter, if you have any unserved detentions, you will receive an incomplete in the course until you have made up your obligations.

Tests - We will have a test at the end of each unit. You will not be able to use any notes on tests since you will not be able to use them on the AP exam. Part of every test will be calculator and part will be non-calculator. This is an AP course, you will be held to a higher standard than in regular classes. Following each test, we will go over the test to make sure that you understand questions that you missed on the tests. Each student will be responsible for completing test corrections which will count as a homework assignment. There will be no retesting. If you have an excused absence on the day of a quiz or test, it is your responsibility to make this work up. This usually requires you to stay after school, come before school, or use your travel time during advisement and must be done within one week of the absence or the test score will become a zero. If you were truant on the day of a quiz or test, you will receive no credit for that assessment. Keep in mind, if you do not receive credit on a test, the likely result will be failing this course.

Notes - You are required to take notes during class. I will collect notes at midterms and the end of each quarter to grade them. Note taking skills are essential to being successful in high school and college math. This will be an opportunity for you to improve those skills. You are expected to keep your notes organized in a bound notebook. I will not grade disorganized or loose leaf notes.

AP Exam – Everyone in the class will be expected to sign up and take the AP exam. This is how you will earn College credit in your class and it is also how I get feedback as to whether I have prepared you appropriately.

Final Exam and Review

In this course, students take a comprehensive final exam in similar format to the AP Exam. This exam consists of both free response and multiple-choice questions, including calculator and non-calculator active portions. During review, students work collaboratively in cooperative groups while working out AP style questions, including previously released AP questions.

IB(HL) – Many of you are enrolled in the IB HL course. Calculus content makes up roughly half of the IB HL curriculum. Students in IB HL will take Calculus AB/BC along with the AP students for the first year of the course and finish the rest of the IB topics in the second year of the course. Following the AP exams, we will spending the remainder of the time on content from the IB HL curriculum that was not covered in the AP curriculum.

Curriculum – We will be covering chapters 1-10 in this course in preparation for the AP Calculus BC Exam.

I. Functions, Graphs, and Limits

Analysis of graphs With the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.

Limits of functions (including one-sided limits)
- An intuitive understanding of the limiting process
- Calculating limits using algebra
- Estimating limits from graphs or tables of data

Asymptotic and unbounded behavior
- Understanding asymptotes in terms of graphical behavior
- Describing asymptotic behavior in terms of limits involving infinity
- Comparing relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth)

Continuity as a property of functions
- An intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the domain.)
- Understanding continuity in terms of limits
- Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem)

* **Parametric, polar, and vector functions** The analysis of planar curves includes those given in parametric form, polar form, and vector form.

II. Derivatives

Concept of the derivative
- Derivative presented graphically, numerically, and analytically
- Derivative interpreted as an instantaneous rate of change
- Derivative defined as the limit of the difference quotient
- Relationship between differentiability and continuity

Derivative at a point
- Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.
- Tangent line to a curve at a point and local linear approximation
- Instantaneous rate of change as the limit of average rate of change
- Approximate rate of change from graphs and tables of values

Derivative as a function
- Corresponding characteristics of graphs of f and f'
- Relationship between the increasing and decreasing behavior of f and the sign of f'
- The Mean Value Theorem and its geometric interpretation

• Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa.

Second derivatives
• Corresponding characteristics of the graphs of f, f', and f''
• Relationship between the concavity of f and the sign of f''
• Points of inflection as places where concavity changes

Applications of derivatives
• Analysis of curves, including the notions of monotonicity and concavity
* Analysis of planar curves given in parametric form, polar form, and vector form, including velocity and acceleration
• Optimization, both absolute (global) and relative (local) extrema
• Modeling rates of change, including related rates problems
• Use of implicit differentiation to find the derivative of an inverse function
• Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
• Geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations
* Numerical solution of differential equations using Euler's method
* L'Hospital's Rule, including its use in determining limits and convergence of improper integrals and series

Computation of derivatives
• Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions
• Derivative rules for sums, products, and quotients of functions
• Chain rule and implicit differentiation
* Derivatives of parametric, polar, and vector functions

III. Integrals

Interpretations and properties of definite integrals
• Definite integral as a limit of Riemann sums
• Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:
• Basic properties of definite integrals (examples include additivity and linearity)

* **Applications of integrals** Appropriate integrals are used in a variety of applications to model physical, biological, or economic situations. Although only a sampling of applications can be included in any specific course, students should be able to adapt their knowledge and techniques to solve other similar application problems. Whatever applications are chosen , the emphasis is on using the method of setting up an approximating Riemann sum and representing its limit as a definite integral. To provide a common foundation, specific applications should include finding the area of a region (including a region bounded by polar curves), the volume of a solid with known cross sections, the average value of a function, the distance traveled by a particle along a line, the length of a curve (including a curve given in parametric form), and accumulated change from a rate of change.

Fundamental Theorem of Calculus
• Use of the Fundamental Theorem to evaluate definite integrals
• Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined

Techniques of antidifferentiation
• Antiderivatives following directly from derivatives of basic functions
* Antiderivatives by substitution of variables (including change of limits for definite integrals), parts, and simple partial fractions (nonrepeating linear factors only)
* Improper integrals (as limits of definite integrals)

Applications of antidifferentiation
• Finding specific antiderivatives using initial conditions, including applications to motion along a line
• Solving separable differential equations and using them in modeling
* Solving logistic differential equations and using them in modeling

Numerical approximations to definite integrals Use of Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values

IV. Polynomial Approximations and Series

Concept of series A series is defined as a sequence of partial sums, and convergence is defined in terms of the limit of the sequence of partial sums. Technology can be used to explore convergence and divergence.

Series of constants
* Motivating examples, including decimal expansion
* Geometric series with applications
* The harmonic series
* Alternating series with error bound
* Terms of series as areas of rectangles and their relationship to improper integrals, including the integral test and its use in testing the convergence of *p*-series
* The ratio test for convergence and divergence
* Comparing series to test for convergence or divergence

Taylor series
* Taylor polynomial approximation with graphical demonstration of convergence (for example, viewing graphs of various Taylor polynomials of the sine function approximating the sine curve)
* Maclaurin series and the general Taylor series centered at $x = a$
* Maclaurin series for the functions e^x, $\sin x$, $\cos x$, and $\frac{1}{1-x}$
* Formal manipulation of Taylor series and shortcuts to computing Taylor series, including substitution, differentiation, antidifferentiation, and the formation of new series from known series
* Functions defined by power series
* Radius and interval of convergence of power series
* Lagrange error bound for Taylor polynomials

* Indicates a topic which is in the BC course but not in the AB course