

Syllabus

AP Calculus AB

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I. COURSE DESCRIPTION

The overall goal of this course is to help students understand and apply the three big ideas of AB Calculus: limits, derivatives, and integrals and the Fundamental Theorem of Calculus. Imbedded throughout the big ideas are the mathematical practices for AP Calculus: reasoning with definitions and theorems, connecting concepts, implementing algebraic/computational processes, connecting multiple representations, building notational fluency, and communicating mathematics orally and in well-written sentences. All students are required to complete summer work reviewing precalculus and Algebra 2 concepts prior to entry in the course. Students will be provided with and expected to regularly use a school issued TI-Nspire CAS CX graphing calculator.

II. CURRICULAR REQUIREMENTS**Unit 1: Prerequisites for Calculus (1 week w/ test)**

- 1.1 Linear Functions
- 1.2 Functions and Graphs
- 1.3 Exponential Functions
- 1.5 Inverse Functions and Logarithms
- 1.6 Trigonometric Functions

Unit 2: Limits and Continuity (3 weeks w/ test)

- 2.1 Rates of Change and Limits
- 2.2 Limits Involving Infinity
- 2.3 Continuity
- 2.4 Rates of Change, Tangent Lines, and Sensitivity

Unit 3: Derivatives (3.5 weeks w/ test)

- 3.1 Derivatives of a Function
- 3.2 Differentiability
- 3.3 Rules for Differentiation
- 3.4 Velocity and Other Rates of Change
- 3.5 Derivatives of Trigonometric Functions

Unit 4: More Derivatives (4 weeks w/ test)

- 4.1 Chain Rule
- 4.2 Implicit Differentiation
- 4.3 Derivatives of Inverse Trigonometric Functions
- 4.4 Derivatives of Exponential and Logarithmic Functions

Unit 5: Applications of Derivatives (4.5 weeks w/ 2 tests)

- 5.1 Extreme Values of Functions
- 5.2 Mean Value Theorem
- 5.3 Connecting f'' and f' with the Graph of f
- 5.4 Modeling and Optimization
- 5.5 Linearization, Sensitivity, and Differentials
- 5.6 Related Rates

Unit 6: The Definite Integral (3 weeks w/ test)

- 6.1 Estimating with Finite Sums
- 6.2 Definite Integrals
- 6.3 Definite Integrals and Antiderivatives
- 6.4 Fundamental Theorem of Calculus
- 6.5 Trapezoidal Rule

Unit 7: Differential Equations and Mathematical Modeling (2 weeks w/ test)

- 7.1 Slope Fields and Euler's Method
- 7.2 Antidifferentiation by Substitution
- 7.4 Exponential Growth and Decay

Unit 8: Applications of Definite Integrals (2 weeks w/ test)

- 8.1 Accumulation and Net Change
- 8.2 Areas in the Plane
- 8.3 Volumes

Unit 9: Sequences, L'Hospital's Rule, and Improper Integrals (3 weeks w/ test)

- 9.1 Sequences
- 9.2 L'Hospital's Rule
- 9.3 Relative Rates of Growth

III. SPECIFIC EXAMPLES

- In Unit One, students develop a library of basic functions, with their various characteristics (domain, continuity, symmetry, end behavior, etc.). Throughout the course, these functions are referred back to again and again so that students begin to “see” those basic functions arise from information given in exercises.
- In Unit Two, a limit exploration is done using graphing calculators. Using tables, students use differing values of h that they select to determine the effect on the limit of a function. Also, an experiment is done in which students have to write out as many primes as possible in a given

period of time. Breaking down the time into 20 second increments, students make a numerical and graphical representation of their work, then determine average and instantaneous rates of change.

- In Unit Three, the limit definition of the derivative is compared and contrasted with the graphing calculator approach of a symmetric difference quotient. This gives both an appreciation for the power of the calculator, but also a demonstration of its occasional deficiencies (i.e finding the derivative of the absolute value function at $x = 0$).
- In Unit Four, students are introduced and study the application of the Chain Rule. Students will become sufficiently familiar with the variety of applications that are accessible once they know how to apply it.
- In Unit Five, students will explore how the understandings of derivatives lead to applications. Students will see how to deduce rates of change that cannot be measured with rates of change that are known, and how to find a function when the first derivative and its value at a single point is known.
- In Unit Six begin the integral calculus. Students will look at integration as accumulation, or antidifferentiation. The Fundamental Theorem of Calculus will also be discussed.
- In Unit Seven, students will study differential equation and mathematical modeling. More specifically, students will use slope fields to analyze solution curves to differentiate equations.
- In Unit Eight, students will study the applications of definite integrals.
- In Unit Nine, students will study sequences, L'Hospital's Rule, and improper integrals.

IV. COURSE MATERIALS

- Text: The primary text used is Calculus: Graphical, Numerical, Algebraic, AP Edition, Fifth Edition, Boston: Pearson Prentice Hall, 2016, by Ross L. Finney, Franklin D. Demana, Bert K. Waits, and Daniel Kennedy.
 - Supplementary texts include Calculus by Larson, Hostetler, and Edwards, 8th edition
 - Released AP exam questions are used extensively throughout the course.

V. TECHNOLOGY

All students will be provided with school issued TI-Nspire CX CAS calculator. They are already familiar with how to use them, having been required to use one in precalculus. Demonstrations are done for the class using a TI ViewScreen. Students learn the four required skills needed for the AP exam (graphing in an arbitrary window, solving an equation, finding numerical derivatives and integrals), but may not use other features (i.e. min/max finder) to perform tasks that can be done with calculus methods. Calculators are encouraged to be used at the beginning of an exercise to get an idea of what is going on, or at the end of an exercise to verify analytical results. They are also used for explorations and investigation of new or unfamiliar topics. Some quizzes are done with calculator, some are done without. Tests are generally done with and without calculators.

VI. STANDARDS OF EVALUATION

40% Assignments and Quizzes

- Assignments are very important for a number of reasons. First, it helps you to understand the concepts from the lesson that you understood or did not understand. It gives you questions to present in class the next day that initiates discussion of homework. Second, it helps the teacher to know what concepts you understand. The attention to detailed, written explanations sheds light on the level of understanding that you have of mathematical concepts.
- Quizzes are given periodically and are always announced. Notes are not allowed on quizzes. Calculators may or may not be allowed. You will be notified.
- Additionally, your detailed work and written explanations set you apart from other students, and it is only those students who work the very hardest and who master the content with deep understanding who deserve to make a top grade of an A in an AP course.

60% Unit test and Free Response Questions

- All exams will be announced and will be in true AP format, with both calculator active and non-calculator active sections. Unit testing will be given over two class days (1 day for calculator active sections and 1 day for non-calculator active sessions).
- You will receive 100 point grades for each test. In other words, a 100 point grade will be recorded for the calculator permitted test and a 100 point grade will be recorded for the non-calculator permitted test.

VII. CLASSROOM EXPECTATIONS AND PROCEDURES

Classroom Expectations:

- Treat people and property with respect at all times.
- Come to class ready to learn by having an open mind and a good attitude.
- Be responsible for your work.
- Bring supplies and homework every day.
- Be in your assigned seat and ready to work when the tardy bell rings/start of class time.

Classroom Procedures:

Each class lesson consists of taking notes, practicing new skills, participating in class activities, and correcting homework. A typical day includes:

1. Quietly sit in your assigned seat and take out required materials.
 2. Begin instructions from the agenda on the board (warm-up activity).
 3. Lesson instruction and work time.
 4. Record assignments for homework and clean-up work area.
- I dismiss class, not necessarily the bell.
 - No food in class. No vending machine purchases during class time.
 - Restroom usage will be limited during class time. Use the restroom before or after class. If you need to go, raise your hand and let Dr. Cook know.
 - Talking during class will not be tolerated except during group activities and classwork time.
 - Students should feel free to come in for extra help after school.

- No cell phones, iPods, etc. unless notified otherwise.

VIII. DISCIPLINE POLICY

- First Offense: Verbal Warning & Parent contact
- Second Offense: Name on the board, Detention, & Parent/Guardian contact
- Third Offense: Citation, referral to administration

Policy for Electronic Devices:

Students must have their cell phones locked in their Yondr pouches. Students will be allowed to use their cell phones ONLY when instructed by Dr. Cook. If a student is caught with his/her cell phone or electronic device, it will be automatically confiscated and progressive discipline will be issued.

Mobile phones can be disruptive in the classroom in a number of ways and their use should not be abused. Ringtones must be turned off in class, in silent mode, or in airplane mode.

Technology use in the classroom is intended to enhance the learning environment for all students. Dr. Cook will decide when, if, and what type of technology is to be used during class. Any use of technology that degrades the learning environment, promotes dishonesty or is used for illegal activities may be prohibited

IV. ADDITIONAL INFORMATION

- I am available for additional help after school Mondays, Tuesdays, and Thursdays only, from 2:30 p.m. to 3:30 p.m. Come prepared with questions; do not expect to be re-taught the lesson.
- Teacher website: www.drcookmath.weebly.com
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