Thornton High School
9351 North Washington • Thornton, CO 80229
Office: (720) 972-4800 • Fax: (720) 972-4999
http://www.thorntonh.adams12.org

Adams12 Five Star Schools

School Year	2017 - 2018	Teacher Name	Robert Pearson
Office	509	Class Room	520
Off Hour	3rd		sites.google.com/a/adams12.org/pearson/
Email Address	robert.a.pearson@adams12.org		

Course Name	AP Calculus (BC)

Course Overview

AP Calculus BC provides students with an intuitive understanding of the concepts of calculus and experience with its methods and applications.

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'Hopital'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 ofapplications 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 (including the study of the equation y· = ky and exponential growth).
+ 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 special functions.
+ 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.

*Course overview from www.collegeboard.org, copyright 2012

The course will be taught through a combination of written exercises, direct instruction, and group work. Additionally, students will be expected to present work in front of the class clearly explaining their approach in the solution of the problem.
In each unit, an emphasis will be placed on representing functions graphically, numerically, analytically, and verbally.
An approved graphing calculator is required for the course. The examples in class will be on TI-83 and TI-84 calculators which are recommended.
In addition to a graphing calculator, students are expected to keep an organized notebook with class notes, homework, and handouts.
In addition to class time, there will be voluntary study sessions on Wednesday afternoons and Saturdays. Dates are yet to be determined.
An exam will be given at the end of each unit of study which will include material from that unit as well as the preceding units. Questions will be a combination of multiple choice and free response questions from past AP exams which will require the student to explain and/or justify their solution in well written sentences.

Text book: Calculus, Graphical, Numerical, Algebraic; Finney, Demana, Waits, Kennedy AP* Edition, 3rd edition

Unit of Study	Topic/Sub-topics for the unit	Approximate Time Spent	Targeted Date of Assessment
UNIT 1: Pre-Calculus Review	Students will review and become proficient at the following Pre-Calculus skills: lines, functions & graphs, exponential & logarithmic functions, trigonometric functions & applications. Here an initial emphasis will be placed on representing functions graphically, numerically, and analytically as well as verbally.	@ 2 weeks	September 3
UNIT 2: Limits & Continuity	Students will be able to identify limits at a point, limits involving infinity, continuity & the Sandwich Theorem. Students will use graphing calculators to explore the concept of continuity and limits by examining tables of values, learning to look closely at either side of an input value, and graphs by looking for asymptotic behavior.	@ 3 weeks	September 25
UNIT 3: The Derivative	Students will be able to define/find the derivative of algebraic functions, as well as determine differentiability & continuity. Rules of differentiation will be taught including the Power rule, Chain Rule, Product Rule, Quotient Rule, and Implicit differentiation. Students will learn to find derivatives analytically, for example using the product rule on a function given as a formula, as well as by using the Numerical Derivative function of the graphing calculator. Students will compare graphs of functions with analytically	@ 4 weeks	October 23

	found derivatives and numerically found derivatives to determine appropriateness of results.		
UNIT 4: Applications of the Derivative	Students will be able to apply derivatives to do the following: calculate extreme values; analyze graphs using the first & second derivatives; solve optimization problems; calculate related rates; and use Newton's method for approximating roots. Students will be familiar with the Extreme Value theorem and the Mean Value theorem. Students will use graphing calculators to solve optimization problems using the graph and table of values and to interpret and support their results.	@ 3 weeks	November 13
UNIT 5: The Definite Integral	Students will be able to estimate areas using finite sums, to understand the definite integral as an area and to find the value on a graphing calculator, find definite integrals analytically by using antiderivatives and the Fundamental Theorem of Calculus.	@ 4 weeks	December 15
UNIT 6: Differential Equations and Mathematical Modeling	Students will be able to antidifferentiate by Substitution and by Parts. Students will also examine problems involving exponential growth and decay and logistic growth. The graphing calculator will be used to do exponential and logistic regression on data tables. Additionally, students will work with functions graphically by sketching slope fields.	@ 4 weeks	February 2
UNIT 7: Applications of Definite Integrals	Students will be able to interpret the integral as net change, find areas in the plane, volumes of solids, and lengths of curves. Numerical integration on the graphing calculator will be used to solve application problems.	@ 4 weeks	February 26
Unit 8: Sequences, L'Hopital's rule, and Improper Integrals	Students will learn to work with arithmetic and geometric sequences and to find the limit of a sequence. Students will learn to work with indeterminate forms and compare growth rates using L'Hopital's rule. Students will learn to work with infinite limits of integration and integrands with infinite discontinuities.	@ 2 weeks	March 11
Unit 9: Infinite Series	Students will be able to represent functions by series and to differentiate and integrate series. Students will be able to construct Taylor series for various functions and will use the graphing calculator to compare the graphs of the series to the graphs of the functions they are representing. Students will be able to determine if a series converges using various convergence tests.	@ 3 weeks	April 1
Unit 10: Parametric, Vector, and Polar Functions	Students will be able to work with parametric, polar, and vector functions as well as perform vector operations. Graphing calculators will be used within groups to compare functions in different forms.	@ 3 weeks	April 22

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Grading Scale		Grade Percentages/Weights		On group projects, students will receive a grade for individual work and a group grade	
A	90-100	Summative Assessments & Projects	80%		
B	80-89	Formative Assessments & Projects	20%	Individual Grade	80%
C	70-79			Group Grade	20%
D	60-69	*Weekly progress grades are posted at https://ic.adams12.org/campus/portal/adams12.isp		Grades are based on achievement of Content Standards and Grade Level Expectations.	
F	59 or below				

Grading Guidelines

1. Homework is available online at mymathlab.com. Homework assignments are given for each section in the textbook, typically about 4 or 5 assignments per chapter. Each assignment is worth 0-10 points in the formative assessments category.
2. Exams are given at the end of each chapter. For chapters 2-8 the exams will take place over two days, no calculators are allowed on the first day, they are allowed on the second. Exams are graded using AP guidelines and will include material from previous chapters.

Re-Take Policy

- Rather than retakes, corrections are allowed on each test handed back. A maximum of 10 points can be earned with test corrections.
- First s**emester final exam** is not eligible for corrections.
- Because the lowest grade that can be entered for a test is a 50%, students have the opportunity to earn a passing grade on every exam.
- Corrections are due no later than one week after an exam is handed back in class.

All students enrolled in this course are required to take the corresponding AP/IB exam in May. If you do not take the exam, your score in this course will be ***unweighted*** *and will impact your GPA. IB exams are non-refundable and after they are ordered, you will be billed for the exam for this class regardless of whether or not you sit for the exam.*

Student Expectations

Behavior Policy

- Each student is expected to behave **appropriately and respectfully** to the teacher and towards other students
- Each student is expected to comply with "reasonable requests"
- Each student is expected to come to class prepared and on time

Tardy Policy

- Students are expected to be in class on time. Students arriving tardy will be subject to discipline under the THS tardy policy.

ID Policy

- We expect all students to have their ID's on their person at all times during the school day.

Cell Phone/Music Policy

- Students will be given **one verbal warning** at the start of class each day to turn off & put away their phones/music
- Any phones/ music **out after the 1st warning will be taken & not returned to the student after class**.
- Phones can be taken for simply being out, even if not in use.
- The phone **can be retrieved at the end of the school day in the Attendance Office** or the student may speak with their dean to try to retrieve it earlier
- Habitual offenders **(more than 3 times per quarter**) will result in parent notification and/or referral to the dean

CU Succeed

- Students in this course have the OPTION of enrolling in the CU Succeed program.
- The tuition for CU Succeed is $77 per credit hour with NO additional fees, this course is a 3 credit hour course.
- The grade earned in the class will be on a CU Denver transcript as Math 2411 (Calculus II)
- For more information, see Mr. Pearson.

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General Expectations

- Grades are based upon the demonstration of proficiency on units associated with a standard given during each formative or summative assessment. Formative grades in addition to summative unit assessments will be used to holistically determine your grade.
- **Summative: 80%** Summative measures of achievement are taken when unit master is expected. (i.e., unit tests, culmination of a project, embedded assessments, etc.)
- **Formative: 20%** Formative assessments measure the scaffolding skills and/or content embedded in the unit. Formative assessments are taken frequently, after a student has practiced a skill or become familiar with content. Examples of formative assessments include but are not limited to exit tickets, paragraphs, oral check for understanding, warm-ups, stages in a large project, etc.
- Assessments will be graded based on teacher/district/state rubrics.
- On group projects, students will receive a grade for individual work and a group grade.
- Grades are based on achievement of Content Standards and Grade Level Expectations.

Homework Policy

- Typically, homework/extra practice problems will be assigned each day (Monday – Friday)
- The expectation is that these assigned problems will **at least be attempted before the next scheduled class day**, so that students are able to ask questions & contribute to classroom discussions.

THS Grading Policy

Definition of a Summative Assessment

- Summative assessments should be a true assessment of a student's learning of a unit.
- Summative assessments should be balanced by formative assessments to check a student's progress.
- Summative assessments should be described in each teacher's class syllabus.
- If the summative assessments are not in line with the department Professional Learning Community, administration has the capacity to aid teachers in determining how many summative and formative assessments are appropriate for student learning (if necessary).

Scoring/Grading of Summative Assessments

- If no attempt to take a summative assessment has been made, a "no evidence" (NE) grade will be recorded until the assessment is completed. NE shall be defined as not attempting the assessment or not being present for the assessment. **NE will be equal to 0%.**
- In order to receive a passing grade, a student must **attempt ALL summative assessments**.
- The presence of a NE grade for any summative assessment at the end of a grading period will result in a grade of F for the course, regardless of performance on other assessments.
- If a student scores lower than a 50% on an assessment, the teacher will add a comment that states "Actual score is ___%". This will flag the assessment for both the teacher and the student so they know what needs to be done as a retake. Once the retake has been completed, the teacher will record the new score

Student and Teacher Responsibilities with regards to Summative Assessments

- **Teachers will be responsible** for communicating NE grades to students. Some examples of this include (<u>but are not limited to</u>): having the student take the NE assessment the next time they are in class; calling home to communicate the NE assessment to parents; having a student make up the NE assessment during a specific off hour, extensions period or lunch, etc.
- If a student is going to fail a semester because of a NE, the **teacher must call home to communicate with the parents** (as per Superintendent policy). This must be done in such a way that it gives students enough time to make up the NE assessment.
- It is the **responsibility of both the teacher and student** to discuss and determine a mutually agreed upon time frame for when the student can make up the NE assessment. If the student fails to meet the given deadline, documentation must be provided in PLP.
- It is the **responsibility of the student** to make up any NE assessments <u>as soon as possible</u> in order to protect his or her eligibility and his/her GPA.
- If a student receives a NE on a final or semester exam, it is the **student's responsibility** to provide documentation

and make arrangements with administration to take the missed assessments.