**Instructors:** Mr. Aaron Cress **Room:**  01-307

**Email:** [aaron.cress@polk-fl.net](mailto:aaron.cress@polk-fl.net) **Website**: [www.arcress.weebly.com](http://www.khsmrbakker.weebly.com)

**Overview:** This course will introduce a variety of topics in the subject of Calculus, including the following: Limits, Derivatives, Minimizations, Integrals, Areas, and Volumes of Rotation. Those enrolled in the AP Calculus class will also be prepared and required upon completion of the class to take the Advanced Placement (AP) Calculus Exam. Upon successful completion of the course, the student will have a functional understanding of Calculus and will be prepared for future studies in collegiate Mathematics. Students will also be able to apply their acquired skills to a variety of real world scenarios and practical applications. Most colleges and universities will give college credit to students scoring a 3 or above on the AP Exam. The goal of this course is to enable every students to achieve college credit for Calculus 1 through the AP Exam.

**Required Materials:** Course textbook (provided by instructor or online), **graphing calculator** (provided by the instructor if needed). AP Calculus students are expected to know what note taking and study strategies work best for them. Some recommended materials are loose leaf paper, pencils, and notebook (a combination of 3-ring binder with pockets alongside a spiral notebook is preferred). Students may additionally find a ruler, graph paper, colored pencils, and highlighters to be helpful, but they are not required.

**CollegeBoard:** Please make sure you have a log in for CollegeBoard. All students will be expected to complete assignments, assessments, and access materials through CollegeBoard.

**Calculator:** A graphing scientific calculator is **required** for this course. At a minimum, the calculator must include basic Calculus functions, such as derivatives, integrals, root-finding, and logarithms. Although there is no required model of calculator, **the recommended model is the TI-Nspire.**

**\*\*I will provide TI-Nspire calculators each student who needs one\*\***

***Students are financially responsible for any loss or damage to the calculators or textbooks.***

The following calculators are approved for use on the AP Calculus Exam: TI-84+, TI-84 Silver, TI-NSpire, Casio FX-9700, Casio CFX-9800, Casio CFX-9950. (Please ask the instructor for all acceptable models).

**CollegeBoard Access:** CollegeBoard has added several new resources for students and teachers. Therefore, each student will be expected to create and utilize a CollegeBoard username and password. There will be several practice assignments completed through the CollegeBoard AP Classroom page. The login link can be found on the class website.

**Grading:** This course will be graded according to the approved Polk County grading scale. Thus, grades will be assigned as follows: A (90-100), B (80-89), C (70-79), D (60-69), F (0-59).

*To receive credit for any assignment, students are required to show work. If there is no work shown, no credit will be given.*

**Grade Computations:** Progress within this course will be measured by a variety of graded coursework. This will include daily homework assignments, weekly quizzes, chapter tests, and notebook evaluations. The final grade for each grading period will be based upon a category system using the following percentages (subject to change at this time):

Semester Grading Breakdown:

* Assessments (Tests / Quizzes): 65%
* Homework Assignments: 35%

Partial credit for all student work is at the discretion of the instructor.

**Assessments:** All classroom assessments are designed to mirror the AP exam, both in format and difficulty. Grades (A – F) correspond to an expected level on the AP exam (5 – 1, respectively). A student who scores a C on a classroom assessment has demonstrated a depth of understanding corresponding to a 3 on the AP Exam. Classroom assessments are designed to be rigorous, so test corrections play a critical role for students maintaining high grades. Test corrections will be completed by the students, in the classroom, and during non-instructional time **provided all other assignments are completed**. Test corrections will allow students an opportunity to earn half of the points taken off for incorrect answers. All tests will be completed using a lockdown browser (through Schoologoy) and CollegeBoard.

**Homework:** Homework is a vital part of learning and practicing the skills necessary to solve practical problems. Homework assignments will be generally given out on a daily basis. All homework assigned will be due the following class day unless otherwise specified by the teacher. Homework is generally worth 50 points. **Homework grades will be graded for *completion*. However, assignments completed through AP Classroom will be graded for correct answers.***To receive credit for any assignment, students are required to show work.* ***If there is no work shown, no credit will be given.***

**All assignments will be turned into Schoology for all students.**

**Late Work Policy****:**A late work policy will be discussed and determined as a class. Once the policy has been designed, the instructor will provide the policy to the parents and post it on the class website.

**Makeup Work:** In accordance with the Polk County Student Code of Conduct, makeup work will be given for all absences ***upon request of the student***. All students will receive an extension of 1 day for each day of continuous absence for all makeup work submission deadlines in order to receive full credit. Makeup quizzes and tests will usually be administered after school at a date and time agreeable to both the teacher and the student, and cannot be taken during class periods. However, makeup quizzes and tests will only be graded at full credit if they are completed within 5 school days or 1 day for each day of continuous absence, whichever is greater; beyond this time all makeup quizzes and tests will be assessed a half-credit penalty. Exceptions to these rules may be made for lengthy illness or other extreme circumstances at the discretion of the teacher. In all cases, however, ***it is the responsibility of the student to request any makeup work from the instructor.***

**Notebooks:** Just as homework is vital to practicing the skills taught in this course, notebooks are vital to recording, sorting, and recalling the skills. It is expected that every student take appropriate notes during each lecture video in a manner that is neat, orderly, and conducive to learning.

**Classroom Policies:** Students are expected to abide by the Polk County Student Code of Conduct and all Kathleen Senior High student policies at all times. In particular, the following policies will be enforced:

* **Textbook Check-out:** The textbook is provided on the class website; however, physical textbooks will be checked out to students. If you are checking a book out, you must fill out the check-out log and get the teacher’s initials upon return. The student is responsible for damage done to the book, and the full cost of the textbook if it is lost.
* **To reiterate, students are financially responsible for calculators and textbooks checked-out in their name.**
* iPods/MP3 players, digital cameras, and other electronic devices are restricted from use in the classroom. A warning will be given for first violations. Students are not allowed to listen to MP3 players during class, especially during assessments. **Cell phones and other smart devices are allowed to be used at the discretion of the teacher. Any use of these devices that does not apply to the lesson at hand is prohibited. This includes texting.**

**Expected Course Schedule**

|  |  |  |
| --- | --- | --- |
| **Unit** | **Approx. Class Periods** | **Topics Covered** |
| Pre-Calculus Review | 7 | * Trigonometric Functions * Reciprocal Trigonometric Functions * Trigonometric Identities * Logarithmic Properties * Logarithmic Identities * Functions of the TI-84 |
| Limits and Continuity | 22-23 | * Can change occur at an instant? * Defining limits and using limit notation * Estimating limit values from graphs * Estimating limit values from tables * Determining limits using algebraic properties of limits * Determining limits using algebraic manipulation * Selecting procedures for determining limits * Determining limits using Squeeze Theorem * Connecting multiple representation of limits * Exploring types of discontinuities * Defining continuity at a point * Confirming continuity over an interval * Removing discontinuities * Connecting infinite limits and vertical asymptotes * Working with the Intermediate Value Theorem (IVT) |
| Differentiation: Definition and Basic Derivative Rules | 13-14 | * Defining average and instantaneous rates of change at a point * Defining the derivative of a function and using derivative notation * Estimating derivatives of a function at a point * Connecting differentiability and continuity: determining when derivatives do and do not exist * Applying the Power Rule * Derivative rules: constant, sum, difference, and constant multiple * Derivatives of and * The Product Rule * The Quotient Rule * Finding the derivatives of tangent and trigonometric reciprocal functions |
| Differentiation: Composite, Implicit, and Inverse Functions | 10-11 | * The Chain Rule * Implicit differentiation * Differentiating inverse functions * Differentiating inverse trigonometric functions * Selecting procedures for calculating derivatives * Calculating higher-order derivatives |
| Contextual Applications of Differentiation | 10-11 | * Interpreting the meaning of the derivative in conext * Straight-line motion: connecting position, velocity, and acceleration * Rates of change in applied contexts other than motion * Introduction to related rates * Solving related rates problems * Approximating values of a function using local linearity and linearization * Using L’Hôpital’s Rule for determining limit of indeterminate forms |
| Analytical Applications of Differentiation | 15-16 | * Using the Mean Value Theorem * Extreme Value Theorem, global versus local extrema, and critical points * Determining intervals on which a function s increasing or decreasing * Using the first derivative test to determine relative (local) extrema * Using the Candidates Test to determine absolute (global) extrema * Determining concavity of functions over their domains * Using the Second Derivative Test to determine extrema * Sketching graphs of functions and their derivatives * Connecting a function, its first derivative, and its second derivative * Introduction to optimization problems * Exploring behaviors of implicit relations |
| Integration and Accumulation of Change | 18-20 | * Exploring accumulation of change * Approximating areas with Reimann Sums * Reimann Sums, summation notation, and definite integral notation * The Fundamental Theorem of Calculus and accumulation functions * Interpreting the behavior of accumulation functions involving area * Applying properties of definite integrals * The Fundamental Theorem of Calculus and definite integrals * Finding antiderivatives and indefinite integrals: basic rules and notation * Integrating using substitution * Integrating functions and using completing the square * Selecting techniques for antidifferentiation |
| Differential Equations | 8-9 | * Modeling situations with differential equations * Verifying solutions for differential equations * Sketching slope fields * Reasoning using slope fields * Finding the general solutions using separation of variables * Finding particular solutions using initial conditions and separation of variables * Exponential models with differentiation |
| Applications of Integration | 19-20 | * Finding the average value of a function on an interval * Connecting position, velocity, and acceleration of functions using integrals * Using accumulation functions and definite integrals in applied contexts * Finding the area between curves expressed as functions of * Finding the area between curves expressed as functions of * Finding the area between curves that intersect at more than two points * Volumes with cross sections: squares and rectangles * Volumes with cross sections: triangles and semicircles * Volume with Disc Method: revolving around the - or -axis * Volume with Disc Method: revolving around other axes * Volume with Washer Method: revolving around the - or -axis * Volume with Washer Method: revolving around other axes |

**Sample Activities**

*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 verbal 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 compare and contrasts jump, removable, and asymptotic discontinuities. They give an oral presentation describing how the different representations reveal the discontinuities in different ways.

*Limit War*: This game uses a set of 24 cards with limits expressed analytically. For each round, players find the limits on their card and announce the answer to their group. The player with the highest result (i.e., infinity, finite values in descending order, negative infinity, and does not exist) wins the cards. Decks are created so that each student receives an equal number of cards with special values in a three-person game. The student with the most cards at the end of the allotted time wins. The game is an introductory week activity with calculators allowed and is repeated as a test review with no calculators. In the cut-throat version, players can steal if their opponent incorrectly evaluates their limit.

*Derivative at a Point, Act 1*: Students use a worksheet to explore the derivative function using the limit definition of the derivative at a point. For several points, students compute the difference quotient algebraically using the definition and use a table and/or graph on their calculators to evaluate the limits and interpret their results in terms of the definition to decide if the derivative does or does not exist at each point. The original function and its derivative values are plotted on two graphs with the same horizontal axes. Students trade papers and validate each other’s answers.

*Derivative at a Point, Act 2*: Students explore the derivative function using tangent lines at a point. Students are given a graph of some function 𝑓𝑓 on easel-size grid paper. At several points, students draw tangent lines and use their slopes to estimate the derivative. Students plot the derivative values on the same set of axes. Graphs may include discontinuous and non-differentiable points. Results are presented to the class.

*Derivative at a Point, Act 3*: Students use Desmos to create a slider showing a function and its derivative. The graph shows the tangent line sliding along the curve as its slope values are plotted. Polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions are used as the parent function on different days.

*Search for 𝒇𝒇*: Using the graph of the derivative 𝑓𝑓′(𝑥𝑥), students determine key features of 𝑓𝑓(𝑥𝑥) (such as increasing/decreasing intervals, local extrema, points of inflection, and concavity intervals) and create a graph of 𝑓𝑓(𝑥𝑥). They exchange 𝑓𝑓(𝑥𝑥) graphs with a different group and make a graph of 𝑓𝑓′(𝑥𝑥) to match their new 𝑓𝑓(𝑥𝑥). The groups meet together to check 𝑓𝑓′(𝑥𝑥) graphs and resolve any differences.

*Rate the Rates*: Students create short videos to act out and solve a related rates or optimization problem. Videos show the original problem set up and have a pause point opportunity that may be used to have the class solve the problem.

*Riemann Sums to Definite Integrals*: Students write an expression for an approximation of the area between the horizontal axis and the graph of 𝑓𝑓(𝑥𝑥) for a particular function given as a formula on a specified interval as a left, right, and midpoint Riemann sum using 𝑛𝑛 subdivisions. They then use a Desmos graph with slider to explore sums. The file superimposes rectangular areas on the graph of 𝑓𝑓(𝑥𝑥), showing the sum value. The software allows for left, right, and midpoint sums. The slider increases the number of partitions to explore precision. Finally, students write limits of their Riemann suns as 𝑛𝑛 goes to infinity, then identify each as a definite integral, and use the Fundamental Theorem of Calculus to evaluate the integral.

*Honeycomb Volume*: In pairs, students find the volume of paper party decorations. Students trace the decoration, measure the outline to construct a data table, and use regression to determine the curve(s) of best fit for their object. They write integrals to represent the volume of their objects as solids of revolution and compute the volumes on their calculators. Pairs will assess the reasonableness of answers and compare results with another team.

*Solids of Revolution*: Students will bring a small object from home that is a solid of revolution. Students will measure their objects to create a graph whose rotation about the 𝑥𝑥-axis would produce their object. Then, they use regression and multiple integrals to compute their object’s theoretical volume. Students will then use displacement to determine the actual volume and calculate their percentage of error.

*Slope Field Card Sort*: Sets of cards include 10 differential equations represented symbolically, as a slope field, and by a verbal description. Students match the cards to bring together all three representations.

*Slope Field Walk*: On an easel-sized piece of graph paper, students produce a slope field for a differential equation. Two general solutions are sketched using two initial values. Students revisit their differential equations the following week and solve them symbolically using separation of variables. Students then solve the IVP’s and compare the actual solution curves with their initial sketches.

*Newton’s Law*: Using temperature probes and CBL’s, students work with Newton’s law of cooling. Groups use containers with varying insulation levels and either hot or cold beverages to determine which container is best.

*Limit War Revisited*: An expansion set of indeterminate form cards is added to the deck. Students work in pairs to examine limits in the context of graphical and analytical representations of rational functions to determine if

and when L’Hospital’s Rule applies. They share their answers with a larger group and jointly resolve any differences.

**Grade Reporting Dates**

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| --- | --- |
| September 9 – 13 | 1st Quarter Interim |
| October 11 | End of 1st Quarter |
| November 11 – 15 | 2nd Quarter Interim |
| December 20 | End of 2nd Quarter |
| February 10 – 14 | 3rd Quarter Interim |
| March 13 | End of 3rd Quarter |
| April 27 – May 1 | 4th Quarter Interim |
| May 28 | End of 4th Quarter |

**Sun ‘n Fun**

April 13 – April 18

**AP Calculus Exam**

May 4th (8:00 A.M.)

**Parent / Student Sign-Off Form**

Dear Parent(s),

It is with enthusiasm and excitement that I welcome your child to my class this year! I look forward to having the opportunity to help instruct your child in Mathematics.

Your child has been given a copy of the syllabus for their class. This syllabus includes important information related to the required materials for the class, as well as the expectations of the student with respect to homework, grading, and classroom policies. I hope that you will be able to take time out of your busy schedule to read the syllabus.

I have also listed below a variety of means to contact me, should the need arise during the year. I have included my school phone number, room number, as well as the address for the website for this course. Please do not hesitate to contact me if you have any questions regarding the course, the materials for the course (such as the model/style of calculator needed), or your child’s ongoing performance in the class.

Please note that your signature, and your child’s, is requested on this paper below. During the course of this class your child may be assigned materials such as calculators or textbooks that will become their responsibility to maintain. If these materials are lost or damaged during the year, your child will be financially responsible for replacing or repairing them as the situation warrants.

Once again, I eagerly look forward to the opportunity to serve you and your child this year.

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| --- | --- |
| Mr. Aaron Cress |  |
| Mathematics Department | Room 01-307 |
| Kathleen Senior High School | aaron.cress@polk-fl.net |

**I hereby indicate that I have read and am aware of the official syllabus of the course being taught. I also indicate that I am aware that the student will be financially responsible for any lost materials checked out to the student by the school, such as textbooks or calculators, at a value sufficient for replacement of the lost material by the school.**

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**Parent / Guardian’s Printed Name Parent / Guardian Phone Number**

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**Parent / Guardian’s Signature Parent / Guardian Email Address**

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**Student’s Signature Date**