Mathematics Department

Scope and Sequence

AP Calculus AB / Calculus I



|  |  |
| --- | --- |
|  |  |
| **Description:** | Calculus is a gateway course in the engineering, medical, business, and scientific fields, and is required in many major fields of study. Topics include: Graphical, numerical, and analytical approaches to the study of functions including linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, hyperbolic, and piecewise-defined functions. Limits, continuity, behavior of graphs, derivatives as a rate of change, integrals as an area under a curve, applications of derivatives and integration, and separable differential equations. Emphasis will be placed on applications in a wide variety of disciplines. This class is an Advanced Placement (AP) and Idaho State University Dual Enrollment approved class. |
| **Book:** | Stewart, James *Single Variable Calculus, 8th Edition*, Massachusetts**,** Cengage Learning (ISBN 978-1-305-270333-6), 2016, print |
| **Prerequisites:** | * Mastery and completion of Pre-Calculus with grade of B or better * A minimum score on one of these standardized tests   + - 29 on Math portion of ACT     - 650 on Math portion of SAT     - 51 on COMPASS (Trigonometry, MAPL 4) |
| **Course Objectives:** | * Work with functions represented in a variety of ways and understand the connections among these representations. * Use the limit concept for scalar functions of one variable. * Understand the meaning of the derivative in terms of a rate of change and local linear approximation, and use derivatives to solve a variety of problems. * Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus. * Understand the meaning of the Integral of a function in one variable both in terms of limits of Riemann sums and in terms of area under a curve, accumulation, and as a function itself. * Use integrals to solve a variety of problems. * Communicate mathematics both orally and in well-written sentences to explain solutions to problems. * Model a written description of a physical situation with a function, a differential equation, or an integral. * Use technology to help solve problems, experiment, interpret results, and support conclusions. * Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement. * Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment. |
| **Course Length:** | This is a three trimester class. |

**This class is taught from an Advanced Placement perspective, so objectives come from**

[**http://media.collegeboard.com/digitalServices/pdf/ap/ap-calculus-course-description.pdf**](http://media.collegeboard.com/digitalServices/pdf/ap/ap-calculus-course-description.pdf)

**Calculus is a thorough review of most concepts from the Idaho State Standards for secondary Mathematics. The link for those, accessed 6/2/16, is http://www.sde.idaho.gov/academic/math/**

**High School Number and Quantity**

**The Real Number System (N-RN)**

**Quantities (N-Q)**

**Vector and Matrix Quantities (N-VM)**

**High School Algebra**

**Seeing Structure in Expressions (A-SSE)**

**Arithmetic with Polynomials and Rational Expressions (A-APR)**

**Creating Equations (A-CED)**

**Reasoning with Equations and Inequalities (A-REI)**

**High School Functions**

**Interpreting Functions (F-IF)**

**Building Functions (F-BF)**

**Linear, Quadratic, and Exponential Models (F-LE)**

**Trigonometric Functions (F-TF)**

**High School Modeling**

**Interspersed throughout**

**High School Geometry**

**Congruence (G-CO)**

**Similarity, Right Triangles, and Trigonometry (G-SRT)**

**Circles (G-C)**

**Expressing Geometric Properties with Equations (G-GPE)**

**Geometric Measurement and Dimension (G-GMD)**

**Modeling with Geometry (G-MG)**

**High School Mathematical Practices (MP)**

**1. Make sense of problems and persevere in solving them.**

**2. Reason abstractly and quantitatively.**

**3. Construct viable arguments and critique the reasoning of others.**

**4. Model with mathematics.**

**5. Use appropriate tools strategically.**

**6. Attend to precision.**

**7. Look for and make use of structure.**

**8. Look for and express regularity in repeated reasoning.**

**Grades:**

|  |  |
| --- | --- |
| Grades are calculated based on the following weighting:  Tests and Quizzes: 80%  Assignments: 20% | Trimester Grades are based on the Madison High School grade scale shown below:  A 94-100% C 73-76%  A- 90-93% C- 70-72%  B+ 87-89% D+ 67-69%  B 83-86% D 63-66%  B- 80-82% D- 60-62%  C+ 77-79% F Below 60% |

Mathematics Department

Scope and Sequence

AP Calculus AB / Calculus I



**Course Outline:**

* **Trimester 1**

|  |  |  |
| --- | --- | --- |
| **Functions and Models** | **Limits and Derivatives** | **Differentiation Rules** |
|  |  |  |
| **Preview of Calculus**  **Representation of Functions**  **Mathematical Models**  **Transformations**  **Exponential Functions**  **Inverse Functions and Logarithms** | **Tangent and Velocity Problems**  **Limits of Functions**  **Limit Laws**  **Precise Definition of Limit ε-δ**  **Continuity**  **Limits at Infinity**  **Derivatives and Rates of Change**  **Derivative as a function** | **Derivatives of Basic Functions**  **Product and Quotient Rules**  **Derivatives of Trig Functions**  **Chain Rule**  **Implicit Differentiation**  **Derivatives of Logarithmic functions**  **Rates of Change in Applications**  **Exponential Growth and Decay**  **Related Rates**  **Linear Approximations and Differentials** |
| 9 Days | 13 Days | 19 Days |
|  |  |  |

* **Trimester 2**

|  |  |  |
| --- | --- | --- |
| **Applications of Differentiation** | **Integrals** | **Applications of Integration** |
| **Extrema**  **Mean Value Theorem**  **Derivatives and Graph Shape**  **L’Hopital’s Rule**  **Summary of Curve Sketching**  **Graphing with Calculators and Calculus**  **Optimization**  **Newton’s Method**  **Antiderivatives** | **Areas and Distances**  **The Definite Integral**  **Fundamental Theorem of Calculus**  **Indefinite Integrals**  **Substitution and Integration** | **Areas Between Curves**  **Volumes**  **Volumes by Cylindrical Shells**  **Average Value** |
| 16 Days | 12Days | 13 Days |
|  |  |  |

* **Trimester 3**

|  |  |
| --- | --- |
| **Additional Topics** | **Preparing for Final and AP Calc AB test/Projects** |
| **Hyperbolic Functions**  **Solving Separable Differential Equations**  **Trapezoid Rule**  **Using Initial Conditions to Solve Differential Equations**  **Intro to Differential Equations**  **Slope Fields** |  |
| 20 Days | 20 Days |