Mathematics Department

Scope and Sequence

AP Calculus AB / Calculus I



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| **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.
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| **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:**

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| 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% |

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 **Course Outline:**

* **Trimester 1**

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| --- | --- | --- |
| **Functions and Models** | **Limits and Derivatives** | **Differentiation Rules** |
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| **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 |
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* **Trimester 2**

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| --- | --- | --- |
| **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 |
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* **Trimester 3**

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| **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 |