Calculus

UC/CSU “c” approved/NCAA approved
Grade Level: 10-12
Estimated Work Outside of Class: 2-4 hrs per week

Course Description:

This course is a two-semester course that covers the elements of beginning college calculus. Topics to be studied include limits, differentiation and integration of polynomial, trigonometric, logarithmic, exponential and other functions. Their applications to area, volume, arc length, optimization, rates of change, position, velocity, and acceleration problems will be studied. This course does not follow the curriculum needed to take the Advanced Placement Exam in Calculus. This course is still challenging and rigorous due simply to the fact that Calculus is very advanced mathematics. This course is ideal for students who would like an introduction to Calculus for college preparation, but do not desire the rigor or pace of the Advanced Placement Course.

Prerequisite:

Completion of Pre-Calculus or AP Pre-Calculus with a grade of “C” or higher both semesters

Recommended Prerequisite Skills:

Students should have a strong foundation in Algebra. These students should have done very well in Algebra 1, Algebra 2/Trig and Pre-Calculus level courses. These students are potentially going to major in a STEM field, but do not want to take the AP Calculus course and want to be ready to excel in college-level Calculus during their freshman year of college. Students must understand this is a rigorous course, and Calculus should only be taken by students truly interested in mathematics.

Course Grade Categories:

- 25% Assignments
- 25% Quizzes
- 50% Formal Assessments

Major Assessments/Units/Topics:

Unit 1 – Limits and Continuity
Limits introduce the subtle distinction between evaluating a function at a point and considering what value the function is approaching, if any, as *x* approaches a point. This distinction allows us to extend understanding of asymptotes and holes in graphs with formal definitions of continuity. Limits are the foundation for differentiation (Unit 2) and integration (Unit 6).
Assessments: At least one quiz and one test

Unit 2 – Differentiation: Definition and Fundamental Properties

Derivatives allow us to determine instantaneous rates of change. To develop understanding of how the definition of the derivative applies limits to average rates of change, create opportunities for students to explore average rates of change over increasingly small intervals. Developing differentiation skills will allow you to model realistic instantaneous rates of change in Unit 4 and to analyze graphs in Unit 5.
Assessments: At least one quiz and one test.

Unit 3 – Differentiation: Composite, Implicit
In this unit, you will learn how to differentiate composite functions using the chain rule and apply that understanding to determine derivatives of implicit and inverse functions.
Assessments: One quiz and one test

Unit 4 – Applications of Differentiation
This unit identifies differentiation as a common underlying structure on which to build understanding of change in a variety of contexts. Students' understanding of units of measure often reinforces their understanding of contextual applications of differentiation. In problems involving related rates, identifying the independent variable common to related functions may help you to correctly apply the chain rule. When applying differentiation to determine limits of certain indeterminate forms using L'Hospital's rule, you will show that the rule applies.
Assessments: At least one quiz and one test

Unit 5 – Analytical Applications of Differentiation
In this unit, the superficial details of contextual applications of differentiation are stripped away to focus on abstract structures and formal conclusions. Reasoning with definitions and theorems establishes that answers and conclusions are more than conjectures; they have been analytically determined. As when you showed supporting work for answers in previous units, you will learn to present justifications for their conclusions about the behavior of functions over certain intervals or the locations of extreme values or points of inflection.
Assessments: At least one quiz and one test

Unit 6 – Integration and Accumulation of Change
This unit establishes the relationship between differentiation and integration using the Fundamental Theorem of Calculus. Students begin by exploring the contextual meaning of areas of certain regions bounded by rate functions. Integration determines accumulation of change over an interval, just as differentiation determines instantaneous rate of change at a point. Students should understand that integration is a limiting case of a sum of products (areas) in the same way that differentiation is a limiting case of a quotient of differences (slopes). Future units will apply the idea of accumulation of change to a variety of realistic and geometric applications.
Assessments: At least one quiz and one test

Unit 7 – Differential Equations
In this unit, you will learn to set up and solve separable differential equations. Slope fields can be used to represent solution curves to a differential equation and build understanding that there are infinitely many general solutions to a differential equation, varying only by a constant of integration. By writing and solving differential equations leading to models for exponential growth and decay and logistic growth, you will build an understanding of topics introduced in Algebra II and other courses.

Assessments: At least one quiz and one test

Unit 8 – Applications of Integration
In this unit, you will learn how to find the average value of a function, model particle motion and net change, and determine areas, volumes, and lengths defined by the graphs of functions. Emphasis will be placed on developing an understanding of integration that can be transferred across these and many other applications.
Assessments: At least one quiz and one test