Montclair High School
Course Syllabus

Department: Mathematics
Course: Calculus III
Level: High Honors
Credits: 5 credits

Course Description:
This course covers vector and multi-variable calculus. Topics include vectors and matrices, parametric curves, partial derivatives, double and triple integrals, and vector calculus in 2- and 3-space.

Standards:

Anchor Text(s):

Text Title	Publisher/Author	Year/Edition	ISBN	Text Distribution
Calculus	Houghton Mifflin/Larson, Hostetler, & Edwards	2002/7th Edition	0-618-14180-4	Hardcopy

Supplementary Materials:
Teacher handouts

Units of Study:
As its name suggests, multivariable calculus is the extension of calculus to more than one variable. That is, in single variable calculus you study functions of a single independent variable

$$y=f(x).$$

In multivariable calculus we study functions of two or more independent variables, e.g.,

$$z=f(x, y) \text{ or } w=f(x, y, z).$$

These functions are interesting in their own right, but they are also essential for describing the physical world.

Many things depend on more than one independent variable. Here are just a few:

1. In thermodynamics pressure depends on volume and temperature.
2. In electricity and magnetism, the magnetic and electric fields are functions of the three space variables (x,y,z) and one time variable t.
3. In economics, functions can depend on a large number of independent variables, e.g., a manufacturer's cost might depend on the prices of 27 different commodities.
4. In modeling fluid or heat flow the velocity field depends on position and time.

5. Single variable calculus is a highly geometric subject and multivariable calculus is the same, maybe even more so. In your calculus class you studied the graphs of functions *y=f(x)* and learned to relate derivatives and integrals to these graphs. In this course we will also study graphs and relate them to derivatives and integrals. One key difference is that more variables means more geometric dimensions. This makes visualization of graphs both harder and more rewarding and useful.

Proficiencies:
By the end of this course, students will:
- Recognize derivatives as rates of change, computed as a limit of ratios
- Integrals as a 'sum,' computed as a limit of Riemann sums

The skills include:
1. Fluency with vector operations, including vector proofs and the ability to translate back and forth among the various ways to describe geometric properties, namely, in pictures, in words, in vector notation, and in coordinate notation.
2. An understanding of a parametric curve as a trajectory described by a position vector; the ability to find parametric equations of a curve and to compute its velocity and acceleration vectors.
3. A comprehensive understanding of the gradient, including its relationship to level curves (or surfaces), directional derivatives, and linear approximation.
4. The ability to compute derivatives using the chain rule or total differentials.
5. The ability to set up and solve optimization problems involving several variables, with or without constraints.
6. The ability to set up and compute multiple integrals in rectangular, polar, cylindrical and spherical coordinates.

Evaluation & Assessment:
- Tests 60%
- Quizzes 30%
- Homework 10%