# Virginia Western Community College
# MTH 265
# Calculus III

## Prerequisites
Completion of MTH 264 or equivalent with a grade of C or better.

## Course Description
Focuses on extending the concepts of function, limit, continuity, derivative, integral and vector from the plane to the three dimensional space. Covers topics including vector functions, multivariate functions, partial derivatives, multiple integrals and an introduction to vector calculus. Features instruction for mathematical, physical and engineering science programs.

**Semester Credits: 4** **Lecture Hours: 4**

## Required Materials
**Textbook:**
University Calculus. Hass, Weir & Thomas. 3rd edition. Pearson/Addison-Wesley. ISBN: 9780321999580.

**Other Required Materials:**
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## Course Outcomes
**At the completion of this course, the student should be able to:**

- Calculate the dot and cross products.
- Graph quadric surfaces and conic sections.
- Use the rectangular, polar, cylindrical, and spherical coordinate systems.
- Analyze and apply vector-valued and parametrized functions, employing their related theorems to describe motion in space, based upon tangent and normal vectors and the principles of curvature.
- Find and interpret the rate of change of a function of several variables.
- Find and interpret gradients and directional derivatives of functions of several variables.
- Express and evaluate area using double integrals in either rectangular or polar coordinate systems.
- Express and evaluate the volume, mass, etc. of a surface using triple integrals.
- Convert and integrate in either the rectangular, spherical, or the cylindrical systems.
- Compute line integrals for both scalar and vector valued functions.
- Apply Green's Theorem and Stoke's Theorem
- Evaluate Surface Integrals and interpret flux of a vector field.
- Find and interpret the divergence and curl of a vector-valued function.

## Topical Description

| Sections | Topics |
|---|---|
| 11 | Vectors and the Geometry of Space |
| 11.1 | Three-Dimensional Coordinate Systems |
| 11.2 | Vectors |
| 11.3 | The Dot Product |
| 11.4 | The Cross Product |
| 11.5 | Lines and Planes in Space |
| 11.6 | Cylinders and Quadric Surfaces |
| 12 | Vector-Valued Functions and Motion in Space |
| 12.1 | Curves in Space and Their Tangents |
| 12.2 | Integrals of Vector Functions; Projectile Motion |
| 12.3 | Arc Length in Space |
| 12.4 | Curvature and Normal Vectors of a Curve |
| 12.5 | Tangential and Normal Components of Acceleration |
| 13 | Partial Derivatives |
| 13.1 | Functions of Several Variables |
| 13.2 | Limits and Continuity in Higher Dimensions |
| 13.3 | Partial Derivatives |
| 13.4 | The Chain Rule |
| 13.5 | Directional Derivatives and Gradient Vectors |
| 13.6 | Tangent Planes and Differentials |
| 13.7 | Extreme Values and Saddle Points |
| 13.8 | Lagrange Multipliers |
| 14 | Multiple Integrals |
| 14.1 | Double and Iterated Integrals over Rectangles |
| 14.2 | Double Integrals over General Regions |
| 14.3 | Area by Double Integration |
| 14.4 | Double Integrals in Polar Form |
| 14.5 | Triple Integrals in Rectangular Coordinates |
| 14.6 | Moments and Centers of Mass |
| 14.7 | Triple Integrals in Cylindrical and Spherical Coordinates |
| 14.8 | Substitutions in Multiple Integrals |
| 15 | Integrals and Vector Fields |
| 15.1 | Line Integrals |
| 15.2 | Vector Fields and Line Integrals: Work, Circulation, and Flux |
| 15. 3 | Path Independence, Conservative Fields, and Potential Functions |
| 15.4 | Green's Theorem in the Plane |
| 15.5 | Surfaces and Area |
| 15.6 | Surface Integrals |
| 15.7 | Stoke's Theorem |
| 15.8 | The Divergence Theorem and a Unified Theory |

## Notes to Instructors

1. A comprehensive final exam will be given.