

**University at Buffalo**  
**GIFTED MATH PROGRAM**

**Course VI Curriculum**

Fall Semester

Course Number: MTH 241  
 Course Title: College Calculus 3  
 Credit Hours: 4.0  
 Textbook: Stewart, *Calculus: Multivariable* (Early Transcendentals, 6<sup>th</sup> ed. / UB custom 6<sup>th</sup> ed.), Brooks/Cole  
 Description: Geometry and vectors of  $n$ -dimensional space; Green's Theorem, Stokes' Theorem, multidimensional differentiation and integration; application to two and three-dimensional space.  
 Prerequisite: MTH 142 with recommended grade of "C" or higher  
 Syllabus: MTH 241 covers Chapters 12 through Chapter 16 of the text.

<b>Week</b>	<b>Section</b>	<b>Topics</b>
1	12.1 – 12.4	Three-Dimensional Coordinate Systems, Vectors, Dot Product, Cross Product
2	12.5 – 12.7	Equations of Lines and Planes, Cylinders and Quadratic Surfaces, Cylindrical and Spherical Coordinates
3	13.1 – 13.3	Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature
4	13.4, 14.1	Motion in Space: Velocity and Acceleration; Functions of Several Variables
5	14.2 – 14.4	Limits and Continuity, Partial Derivatives, Tangent Planes and Linear Approximation
6	14.5 – 14.7	Chain Rule, Directional Derivatives and Gradient Vector, Maximum and Minimum Values
7	14.8, 15.1-15.2	Lagrange Multiplier, Double Integrals over Rectangles, Iterated Integrals
8	15.3 – 15.5	Double Integrals over General Regions, Double Integrals in Polar Coordinates, Applications of Double Integrals
9	15.6 – 15.8	Surface Area, Triple Integrals, Triple Integrals in Cylindrical and Spherical Coordinates <i>Option: Section 15.9 Change of Variables in Multiple Integrals</i>
10	16.1 – 16.4	Vector Fields, Line Integrals, Fundamental Theorem for Line Integrals, Green's Theorem
11	16.5 – 16.7	Curl and Divergence, Parametric Surfaces and their Area, Surface Integrals
12	16.8 – 16.9	Stokes' Theorem, Divergence Theorem

**University at Buffalo**  
**GIFTED MATH PROGRAM**

**Course VI Curriculum**

Spring Semester

Course Number:	MTH 309
Course Title:	Introduction to Linear Algebra
Credit Hours:	4.0
Textbook(s):	David Lay, <i>Linear Algebra and its Applications</i> , 3 <sup>rd</sup> ed., Addison Wesley (UB custom edition is identical to standard editions.)
Description:	Linear equations, linear transformations, matrices, determinants, vector spaces, eigenvalues and eigenvectors, inner products, orthogonality, quadratic forms.
Prerequisite:	MTH 142 (Calculus 2) or MTH 192 (Discrete Math 2)
Syllabus:	Chapters 1 through 7 as specified below.

<i>Section</i>	<i>Title</i>	<i>Topics</i>
1.1 – 1.8	Linear Equations in Linear Algebra	Systems of linear equations. Row reduction and echelon forms. Vector equations. $Ax=b$ . Solution sets of linear systems. Applications of linear systems. Linear independence. Linear transformations.
2.1 – 2.3 2.8 – 2.9	Matrix Algebra	Matrix operations. Inverse of a matrix. Characterizations of invertible matrices. Subspaces of $\mathbb{R}^n$ . Dimension and rank.
3.1 – 3.2	Determinants	Introduction to determinants. Properties of determinants.
4.1 – 4.6	Vector Spaces	Vector spaces and subspaces. Null spaces, column spaces, and linear transformations. Linearly independent sets, bases. Coordinate systems. Dimension of a vector space. Rank.
5.1 – 5.5	Eigenvalues and Eigenvectors	Eigenvectors and eigenvalues. Characteristic equation. Diagonalization. Eigenvectors and linear transformations. Complex eigenvalues.
6.1 – 6.5	Orthogonality and Least Squares	Inner product, length, orthogonality. Orthogonal sets. Orthogonal projections. Gram-Schmidt process. Least squares problem.
7.1 – 7.2	Symmetric Matrices and Quadratic Forms	Diagonalization of symmetric matrices. Quadric forms.