# University at Buffalo
# *GIFTED MATH PROGRAM*

## Course V Curriculum

Fall Semester

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| Course Number: | MTH 141 |
| Course Title: | College Calculus I |
| Credit Hours: | 4.0 |
| Textbook: | Stewart, ***Calculus, Early Transcendentals: MTH141, 142*** (8th edition, UB custom), Cengage Learning |
| Catalogue Description: | This is the beginning of a 3-semester sequence in calculus for students of mathematics, natural sciences and engineering. Covers differentiation and integration with applications. |
| Prerequisite: | NYS Regents Algebra II or MTH 115 |
| Syllabus: | MTH 141 covers through Chapter 5 of the text. |

| Week | Section | Topics |
|---|---|---|
| 1 | 2.1 | Tangent and Velocity Problems |
| 1 | 2.2 | Limit of a Function |
| 1 | 2.3 | Calculating Limits Using Limit Laws |
| 2 | 2.4 | Precise Definition of a Limit, Infinite Limits |
| 2 | 2.5 | Continuity |
| 3 | 2.6 | Limits at Infinity; Horizontal Asymptotes |
| 3 | 2.7 | Tangents, Velocities, and Other Rates of Change |
| 4 | 2.8 | Derivatives |
| 4 | 2.9 | The Derivative as a Function |
| 4 | 3.1i | Derivatives of Polynomial Functions |
| 5 | 1.5 | Exponential Functions |
| 5 | 1.6 | Inverse Functions and Logarithms, Inverse Trigonometric Functions |
| 5 | 3.1ii | Derivatives of Exponential Functions |
| 5 | 3.2 | The Product and Quotient Rules |
| 6 | 3.4 | Derivatives of Trigonometric Functions |
| 6 | 3.5 | The Chain Rule |
| 6 | 3.6 | Implicit Differentiation, Derivatives of Inverse Trigonometric Functions |
| 7 | 3.7 | Higher Derivatives |
| 7 | 3.8 | Derivatives of Logarithmic Functions |
| *option* | *3.9* | *Hyperbolic Functions* |
| *option* | *3.10* | *Related Rates* |
| 7 | 3.11 | Linear Approximation and Differentials |
| 8 | 4.1 | Maximum and Minimum Values |
| 8 | 4.2 | The Mean Value Theorem |
| 8 | 4.3 | How Derivatives Affect the Shape of a Graph |
| 9 | 4.4 | Indeterminate Forms and L'Hopital's Rule |
| 9 | 4.5 | Summary of Curve Sketching |
| *option* | *4.6* | *Graphing with Calculus and Calculators* |
| 9 | 4.7 | Optimization Problems |
| *option* | *4.8* | *Applications to Business and Economics* |
| *option* | *4.9* | *Newton's Method* |
| 10 | 4.10 | Antiderivatives |
| 10 | 5.1 | Areas and Distances |
| 11 | 5.2 | The Definite Integral |
| 11 | 5.3 | The Fundamental Theorem of Calculus |
| 12 | 5.4 | Indefinite Integrals and the Net Change Theorem |
| 12 | 5.5 | The Substitution Rule |
| *option* | *5.6* | *The Logarithm Defined as an Integral* |

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## *GIFTED MATH PROGRAM*

### <u>Course V Curriculum</u>

Spring Semester

Course Number:    MTH 142

Course Title:    College Calculus 2

Credit Hours:    4.0

Textbook:    Stewart, ***Calculus, Early Transcendentals: MTH141, 142*** (8th edition, UB custom), Cengage Learning

Catalogue
Description:    Differentiation and integration of transcendental functions; infinite sequences; series and power series; integration methods; additional topics in analytic geometry.

Prerequisite:    MTH 141 with recommended grade of "C" or higher.

Syllabus:    MTH 142 covers (parts of) Chapter 5 through 11 of the text.

| Week | Section | Topics |
|---|---|---|
| 1 | 5.5 | The Substitution Rule |
| 1 | 6.1 | Areas Between Curves |
| 2 | 6.2 | Volumes |
| 2 | 6.3 | Volumes by Cylindrical Shells |
| *option* | *6.4* | *Work* |
| 2 | 6.5 | Average Value of a Function |
| 3. | 7.1 | Integration by Parts |
| 3 | 7.2 | Trigonometric Integrals |
| 4 | 7.3 | Trigonometric Substitution |
| 4 | 7.4 | Integration of Rational Functions by Partial Fractions |
| 5 | 7.5 | Strategy for Integration |
| 6 | 7.7 | Approximate Integration |
| 6 | 7.8 | Improper Integrals |
| 6 | 8.1 | Arc Length |
| 7 | 8.2 | Area of a Surface of Revolution |
| *option* | *8.3* | *Applications to Physics and Engineering* |
| *option* | *8.4* | *Applications to Economics and Biology* |
| *option* | *8.5* | *Probability* |
| 7 | 9.4 | Exponential Growth and Decay |
| 8 | 10.1 | Curves Defined by Parametric Equations |
| 8 | 10.2 | Calculus with Parametric Curves |
| 8 | 11.1 | Sequences |
| 9 | 11.2 | Series |
| 9 | 11.3 | The Integral Test and Estimates of Sums |
| 9 | 11.4 | Comparison Tests |
| 10 | 11.5 | Alternating Series |
| 10 | 11.6 | Absolute Convergence & the Ratio Test |
| 10 | 11.7 | Strategy for Testing Series |
| 10 | 11.8 | Power Series |
| 11 | 11.9 | Representation of Functions as Power Series |
| 11 | 11.10 | Taylor and McLaurin Series |
| 11 | 11.11 | The Binomial Series |
| 11 | 11.12 | Applications of Taylor Polynomials |
| 12 | 10.3 | Polar Coordinates |
| 12 | 10.4 | Areas and Lengths in Polar Coordinates |
| *option* | *10.5* | *Conic Sections* |
| *option* | *10.6* | *Conic Sections in Polar Coordinates* |