COWLEY COLLEGE
& Area Vocational Technical School

COURSE PROCEDURE FOR

CALCULUS I
MTH4435   5 Credit Hours

Student Level:
This course is open to students on the college level in the freshman and/or sophomore year.

Prerequisites:
Minimum grade of C or better in MTH4425 Trigonometry, or minimum grade of C or better in MTH4420 College Algebra or MTH4432 Calculus for Business and Economics with recent trigonometry in high school, or satisfactory course placement assessment of 25 ACT math score with recent trigonometry in high school.

Controlling Purpose:
Elementary calculus is the threshold of all higher mathematical analysis and is an essential tool for achieving important objectives in business and economics, statistics, the sciences, engineering, and technology. Any student of these disciplines should learn the basic techniques of analysis, acquire an understanding of the range of its application to their discipline, and develop a high degree of proficiency in making those applications. Calculus I is designed to launch the student toward that endeavor.

Learner Outcomes:
Upon completion of the course, the student will gain skills in limits, continuity, differentiation and integration, and use them in analyzing and solving applications in the fields; business, social, physical and life sciences.

Units Outcomes and Criterion Based Evaluation Key for Core Content:
The following defines the minimum core content not including the final examination period. Instructors may add other content as time allows.

Evaluation Key:

A   =   All major and minor goals have been achieved and the achievement level is considerably above the minimum required for doing more advanced work in the same field.

B   =   All major goals have been achieved, but the student has failed to achieve some of the less important goals. However, the student has progressed to the point where the goals of work at the next level can be easily achieved.

C   =   All major goals have been achieved, but many of the minor goals have not been achieved. In this grade range, the minimum level of proficiency represents a person who has achieved the major goals to the minimum amount of preparation necessary for taking more advanced work in the same field, but without any major handicap of inadequacy in his background.

D   =   A few of the major goals have been achieved, but the student's achievement is so limited that he is not well prepared to work at a more advanced level in the same field.

F   =   Failing, will be computed in GPA and hours attempted.

N   =   No instruction or training in this area.

CHAPTER P:	PREPARATION FOR CALCULUS
Outcomes:	Upon completion of this unit students will be able to recall and apply graphing skills and operations on functions for the standard functions of algebra and trigonometry.

A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						*P.1	Sketch the graph of an equation.
						*P.1	Find the intercepts of a graph.
						*P.1	Test a graph for symmetry with respect to an axis and the origin.
						*P.1	Find the points of intersection of two graphs.
						*P.1	Interpret mathematical models for real-life data.
						*P.2	Find the slope of a line passing through two points.
						*P.2	Write the equation of a line with a given point and slope.
						*P.2	Interpret slope as a ratio or as a rate in a real-life application.
						*P.2	Sketch the graph of a linear equation in slope-intercept form.
						*P.2	Write equations of lines that are parallel or perpendicular to a given line.
						*P.3	Use function notation to represent and evaluate a function.
						*P.3	Find the domain and range of a function.
						*P.3	Sketch the graph of a function
						*P.3	Identify different types of transformations of functions.
						*P.3	Classify functions and recognize combinations of functions.
						*P.4	Fit a linear model to a real-life data set.
						*P.4	Fit a quadratic model to a real-life data set.
						*P.4	Fit a trigonometric model to a real-life set.

CHAPTER 1:	LIMITS AND THEIR PROPERTIES
Outcomes:	Upon completion of this unit, students will be able to apply basic theorems and techniques of limits and continuity to the standard functions of algebra and trigonometry.

A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						1.1	Understand what calculus is and how it compares to precalculus.
						1.1	Understand that the tangent line problem is basic to calculus.
						1.1	Understand that the area problem is also basic to calculus.
						1.2	Estimate a limit using a numerical or graphical approach.
						1.2	Learn different ways that a limit can fail to exist.
						1.2	Study and use a formal definition of a limit.
						1.3	Evaluate a limit using properties of limits.
						1.3	Develop and use a strategy for finding limits.
						1.3	Evaluate a limit using cancellation and rationalization techniques.
						1.3	Evaluate a limit using the Squeeze Theorem.
						1.4	Determine continuity at a point and continuity on an open interval.
						1.4	Determine one-sided limits and continuity on a closed interval.
						1.4	Use properties of continuity.
						1.4	Understand and use the Intermediate Value Theorem.
						1.5	Determine infinite limits from the left and from the right.
						1.5	Find and sketch the vertical asymptotes of the graph of a function.

							Specific Competencies Demonstrate the ability to:
A	B	C	D	F	N		

CHAPTER 2: DIFFERENTIATION
Outcomes: Upon completion of this unit, the students will be able to find derivatives of functions and higher order derivatives, and make useful elementary applications.

A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						2.1	Find the slope of the tangent line to a curve at a point.
						2.1	Use the limit definition to find the derivative of a function.
						2.1	Understand the relationship between differentiability and continuity.
						2.2	Find the derivative of a function using the Constant Rule.
						2.2	Find the derivative of a function using the Power Rule.
						2.2	Find the derivative of a function using the Constant Multiple Rule.
						2.2	Find the derivative of a function using the Sum and Difference Rules.
						2.2	Find the derivative of the sine function and of the cosine function.
						2.2	Use derivatives to find rates of change.
						2.3	Find the derivative of a function using the Product Rule.
						2.3	Find the derivative of a function using the Quotient Rule.
						2.3	Find the derivative of a trigonometric function.
						2.3	Find a higher-order derivative of a function.
						2.4	Find the derivative of a composite function using the Chain Rule.
						2.4	Find the derivative of a function using the General Power Rule.
						2.4	Simplify the derivative of a function using algebra.
						2.4	Find the derivative of a trigonometric function using the Chain Rule.
						2.5	Distinguish between functions written in implicit form and explicit form.
						2.5	Use implicit differentiation to find the derivative of a function.

CHAPTER 2: DIFFERENTIATION							
Outcomes: Upon completion of this unit, the students will be able to find derivatives of functions and higher order derivatives, and make useful elementary applications.							
A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						2.6	Find a related rate.
						2.6	Use related rates to solve real-life problems.

CHAPTER 3: APPLICATIONS OF DIFFERENTIATION							
Outcomes: Upon completion of the unit, students will be able to use the first and second derivative to analyze a function, sketch its graph, and determine extreme values over a defined interval.							
A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						3.1	Understand the definition of extrema of a function on an interval.
						3.1	Understand the definition of relative extrema of a function on an open interval.
						3.1	Find extrema on a closed interval.
						3.2	Understand and use Roll's Theorem.
						3.2	Understand and use the Mean Value Theorem.
						3.3	Determine intervals on which a function is increasing or decreasing.
						3.3	Apply the First Derivative Test to find relative extrema of a function.
						3.4	Determine intervals on which a function is concave upward or concave downward.
						3.4	Find any points of inflection of the graph of a function.
						3.4	Apply the Second Derivative Test to find relative extrema of a function.
						3.5	Determine (finite) limits at infinity.
						3.5	Determine the horizontal asymptotes, if any, of the graph of a function.
						3.5	Determine infinite limits at infinity.

CHAPTER 3: APPLICATIONS OF DIFFERENTIATION

Outcomes: Upon completion of the unit, students will be able to use the first and second derivative to analyze a function, sketch its graph, and determine extreme values over a defined interval.

A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						3.6	Analyze and sketch the graph of a function.
						3.7	Solve applied minimum and maximum problems.
						*3.8	Approximate a zero of a function using Newton's Method.
						3.9	Understand the concept of a tangent line approximation.
						3.9	Compare the value of the differential, dy, with the actual change in y, Δy.
						3.9	Estimate a propagated error using a differential.
						3.9	Find the differential of a function using differention formulas.

CHAPTER 4: INTEGRATION

Outcomes: Upon completion of the unit, students will be able to use the antiderivative to find indefinite and definite integrals.

A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						4.1	Write the general solution of a differential equation.
						4.1	Use indefinite integral notation for antiderivatives.
						4.1	Use basic integration rules to find antiderivatives.
						4.1	Find a particular solution of a differential equation.
						4.2	Use sigma notation to write and evaluate a sum.
						4.2	Understand the concept of area.
						4.2	Approximate the area of a plane region.
						4.2	Find the area of a plane region using limits.
						4.3	Understand the definition of a Riemann sum.

CHAPTER 4:	INTEGRATION						
Outcomes:	Upon completion of the unit, students will be able to use the antiderivative to find indefinite and definite integrals.						
A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						4.3	Evaluate a definite integral using limits and properties of definite integrals.
						4.4	Evaluate a definite integral using the Fundamental Theorem of Calculus.
						4.4	Understand and use the Mean Value Theorem for Integrals.
						4.4	Find the average value of a function over a closed interval.
						4.4	Understand and use the Second Fundamental Theorem of Calculus.
						4.5	Use pattern recognition to evaluate an indefinite integral.
						4.5	Use a change of variables to evaluate an indefinite integral.
						4.5	Use the General Power Rule for Integration to evaluate an indefinite integral.
						4.5	Use a change of variables to evaluate a definite integral.
						4.5	Evaluate a definite integral involving an even or odd function.
						4.6	Approximate a definite integral using the Trapezoidal Rule and Simpson's Rule.
						4.6	Analyze the approximate error in the Trapezoidal Rule and in Simpson's Rule.

CHAPTER 5:		LOGARITHMIC, EXPONENTIAL, AND OTHER TRANSCENDENTAL FUNCTIONS					
Outcomes:		Upon completion of the unit, students will be able to use the antiderivative to find indefinite and definite integrals.					
A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
						5.1	Develop and use properties of the natural logarithmic function.
						5.1	Understand the definition of the number e.
						5.1	Find derivatives of functions involving the natural logarithmic function.
						5.2	Use the Log Rule for Integration to integrate a rational function.
						5.2	Integrate trigonometric functions.
						5.3	Verify that one function is the inverse function of another function.
						5.3	Determine whether a function has an inverse function.
						5.3	Find the derivative of an inverse function.
						5.4	Develop properties of the natural exponential function.
						5.4	Differentiate natural exponential functions.
						5.4	Integrate natural exponential functions.
						5.5	Define exponential functions that have bases other than *e*.
						5.5	Differentiate and integrate exponential functions that have bases other than *e*.
						5.5	Use exponential functions to model compound interest and exponential growth.
						5.6	Use separation of variables to solve a simple differential equation.
						5.6	Use exponential functions to model growth and decay in applied problems.
						5.7	Use initial conditions to find particular solutions of differential equations.
						5.7	Recognize and solve differential equations that can be solved by separation of variables.
						5.7	Recognize and solve homogeneous differential equations.

A	B	C	D	F	N		Specific Competencies Demonstrate the ability to:
							CHAPTER 5: LOGARITHMIC, EXPONENTIAL, AND OTHER TRANSCENDENTAL FUNCTIONS Outcomes: Upon completion of the unit, students will be able to use the antiderivative to find indefinite and definite integrals.
						5.7	Use a differential equation to model and solve an applied problem.
						5.8	Develop properties of the six inverse trigonometric functions.
						5.8	Differentiate an inverse trigonometric function.
						5.8	Review the basic differentiation formulas for elementary functions.
						5.9	Integrate functions whose antiderivatives involve inverse trigonometric functions.
						5.9	Use the method of completing the square to integrate a function.
						5.9	Review the basic integration formulas involving elementary functions.
						5.10	Develop properties of hyperbolic functions.
						5.10	Differentiate and integrate hyperbolic functions.
						5.10	Develop properties of inverse hyperbolic functions.
						5.10	Differentiate and integrate functions involving inverse hyperbolic functions.

Projects Required:
Projects may or may not be required. Any projects will be announced in class.

Textbook:
Contact Bookstore for current textbook.

Materials/Equipment Required:
Graphics Calculator, TI-83 or TI-84 Plus.

Attendance Policy:
Students should adhere to the attendance policy outlined by the instructor in the course syllabus.

Grading Policy:
The grading policy will be outlined by the instructor in the course syllabus.

Maximum class size:
Based on classroom occupancy

Course Timeframe:

The U.S. Department of Education, Higher Learning Commission and the Kansas Board of Regents define credit hour and have specific regulations that the college must follow when developing, teaching and assessing the educational aspects of the college. A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for approximately fifteen weeks for one semester hour of credit or an equivalent amount of work over a different amount of time. The number of semester hours of credit allowed for each distance education or blended hybrid courses shall be assigned by the college based on the amount of time needed to achieve the same course outcomes in a purely face-to-face format.

Catalog Description:

MTH4435 - CALCULUS I (5 hrs)
This course includes differentiation and integration of the algebraic, logarithmic, and exponential functions, applications to physical, social, life, and business sciences. This course requires that the student furnish their TI-83 or TI-84 Series-graphing calculator. Prerequisite: Minimum grade of C or better in MTH4425 Trigonometry, or minimum grade of C or better in MTH4420 College Algebra or MTH4432 Calculus for Business and Economics with recent trigonometry in high school, or satisfactory course placement assessment of 25 ACT math score with recent trigonometry in high school.

Refer to the following policies:

402.00 Academic Code of Conduct
263.00 Student Appeal of Course Grades
403.00 Student Code of Conduct

Disability Services Program:

Cowley College, in recognition of state and federal laws, will accommodate a student with a documented disability. If a student has a disability, which may impact work in this class which requires accommodations, contact the Disability Services Coordinator.