Course Title & Number: MAT*H254 Calculus I

Competency Area: **QUANTITATIVE REASONING** (Goal: Students will learn to recognize, understand, and use the quantitative elements they encounter in various aspects of their lives. Students will develop a habit of mind that uses quantitative skills to solve problems and make informed decisions.)

Faculty submitting the Learning Outcomes: Jane Wampler, Harry Burt, Ruth Urbina-Lilback, Katie Lozo ***Date***: 3/7/13

[Instructions: *Please match the Learning Outcomes in the left hand column to those of the course you are submitting for Gen Ed approval. List the corresponding course outcomes in the right hand column to indicate a match*.]

BOR TAP's Learning Outcomes	Corresponding Outcomes for Course Named Above
1. Represent mathematical and quantitative information symbolically, graphically, numerically, and verbally.	A3. Identify and calculate essential aspects of functions (define a function, use of function notation, graph functions, domain, range, identify symmetry, odd/even classification, use function notation) B1. Give informal and formal definitions of limits. The $\delta-\varepsilon$ definition (formal) is used to prove limits of linear and/or quadratic functions. B2. Find one and two sided limits algebraically (cancellation, technique, rationalization and application of squeeze theorem) of functions including trigonometric functions. B3. Define and test continuity of a function at a point, an open, or a closed interval. B5. Define infinite limit and find vertical asymptotes of functions. C2. Use the definition to find a function's derivative. C5. Calculate average velocity, instantaneous velocity, and acceleration of an object moving in a straight line. C7. Apply the meaning of derivative as a rate of change to applications involving functions. C9. Find the derivative of a function that is defined implicitly. D1. Find absolute and relative extrema of a function. D2. Apply Rolle's Theorem and the Mean Value Theorem to functions. D3. Identify intervals where a function is increasing or decreasing. D4. Use the first derivative test to find relative maximum and relative minimum values of a function. D5. Identify the concavity of a function on an interval and use the second derivative test to find it. D7. Use the first and the second derivatives to solve applications involving optimization.

	E5.State the Fundamental Theorem of Calculus and apply it to finding a definite integral.
2. Apply quantitative methods to investigate routine and novel problems. This includes calculations/procedures, mathematical and/or statistical modeling, prediction, and evaluation.	A2. Solve equations (polynomial, rational, trigonometric) and inequalities (polynomial and rational) A4. Calculate midpoint and distance between points in the coordinate plane B2. Find one and two sided limits algebraically (cancellation, technique, rationalization and application of squeeze theorem) of functions including trigonometric functions. B3. Define and test continuity of a function at a point, an open, or a closed interval. B5. Define infinite limit and find vertical asymptotes of functions. C2. Use the definition to find a function's derivative. C3. Use the derivative to find the slope of a function at a point and write the equation of the tangent line. C5. Calculate average velocity, instantaneous velocity, and acceleration of an object moving in a straight line. C6. Find the second derivative of a function. C7. Apply the meaning of derivative as a rate of change to applications involving functions. C8. Apply algebraic rules for finding derivatives (Constant, Power, Constant multiple, Sum and Difference, Product, Quotient and Chain rule). This includes trigonometric functions. C9. Find the derivative of a function that is defined implicitly. C10. Use implicit differentiation to solve problems involving related rates. D1. Find absolute and relative extrema of a function. D2. Apply Rolle's Theorem and the Mean Value Theorem to functions. D3. Identify intervals where a function is increasing or decreasing. D4. Use the first derivative test to find relative maximum and relative minimum values of a function. D5. Identify the concavity of a function on an interval and use the second derivative test to find it. D6. Use information from the function, its first derivative, and its second derivative to sketch the graph of the function. D7. Use the first and the second derivatives to solve applications involving optimization. D9. Use differentials as estimates of the change in function values on an interval. E1.Find an antiderivative of a function. E2.Use rectangles to approximate the area of a plane region. E4.Use Riemann sums and the definite integral to find the area of a plane

	region. E5.State the Fundamental Theorem of Calculus and apply it to finding a definite integral. E6.Perform integration by substitution.
3. Interpret mathematical and quantitative information and draw logical inferences from representations such as formulas, equations, graphs, tables, and schematics.	A3. Identify and calculate essential aspects of functions (define a function, use of function notation, graph functions, domain, range, identify symmetry, odd/even classification, use function notation) A4. Calculate midpoint and distance between points in the coordinate plane B2. Find one and two sided limits algebraically (cancellation, technique, rationalization and application of squeeze theorem) of functions including trigonometric functions. B3. Define and test continuity of a function at a point, an open, or a closed interval. B5. Define infinite limit and find vertical asymptotes of functions. C2. Use the definition to find a function's derivative. C3. Use the derivative to find the slope of a function at a point and write the equation of the tangent line. C5. Calculate average velocity, instantaneous velocity, and acceleration of an object moving in a straight line. C6. Find the second derivative of a function. C7. Apply the meaning of derivative as a rate of change to applications involving functions. C10. Use implicit differentiation to solve problems involving related rates. D2. Apply Rolle's Theorem and the Mean Value Theorem to functions. D3. Identify intervals where a function is increasing or decreasing. D4. Use the first derivative test to find relative maximum and relative minimum values of a function. D5. Identify the concavity of a function on an interval and use the second derivative test to find it. D6. Use information from the function, its first derivative, and its second derivative to sketch the graph of the function. D7. Use the first and the second derivatives to solve applications involving optimization. D9. Use differentials as estimates of the change in function values on an interval. E2.Use rectangles to approximate the area of a plane region. E4.Use Riemann sums and the definite integral to find the area of a plane region. E5.State the Fundamental Theorem of Calculus and apply it to finding a definite integral.

4. Evaluate the results obtained from quantitative methods for accuracy and/or reasonableness.	Evaluate the results obtained from quantitative methods for accuracy and/or reasonableness.
	Additional Outcomes A1. Write interval notation for number sets B4. Use the Intermediate Value Theorem. B6. Investigate limits involving exponential functions. C1. Define the derivative of a function. C4. Investigate derivatives of exponential functions. D8. Define differentials. E3.Define definite integral.