12002 Analytic Geometry and Calculus I (5)

In a Calculus I course, students should:

• develop mathematical thinking and communication skills and learn to apply precise, logical reasoning to problem solving.
• be able to communicate the breadth and interconnections of the mathematical sciences through being presented key ideas and concepts from a variety of perspectives, a broad range of examples and applications, connections to other subjects, and contemporary topics and their applications.
• experience geometric as well as algebraic viewpoints and approximate as well as exact solutions.
• use computer technology to support problem solving and to promote understanding, as most calculus students, especially those who may take only one semester, profit from the use of a graphing utility and a tool for numerical integration.
• for students in the mathematical sciences, progress from a procedural/computational understanding of mathematics to a broad understanding encompassing logical reasoning, generalization, abstraction, and formal proof; gain experience in careful analysis of data; and become skilled at conveying their mathematical knowledge in a variety of settings, both orally and in writing.

The successful Calculus I student should be able to apply the following competencies to a wide range of functions, including piecewise, polynomial, rational, algebraic, trigonometric, inverse trigonometric, exponential and logarithmic:

1. Determine the existence of, estimate numerically and graphically and find algebraically the limits of functions. Recognize and determine infinite limits and limits at infinity and interpret them with respect to asymptotic behavior.*
2. Determine the continuity of functions at a point or on intervals and distinguish between the types of discontinuities at a point.*
3. Determine the derivative of a function using the limit definition and derivative theorems. Interpret the derivative as the slope of a tangent line to a graph, the slope of a graph at a point, and the rate of change of a dependent variable with respect to an independent variable.*
4. Determine the derivative and higher order derivatives of a function explicitly and implicitly and solve related rates problems.*
5. Determine absolute extrema on a closed interval for continuous functions and use the first and second derivatives to analyze and sketch the graph of a function, including determining intervals on which the graph is increasing, decreasing, constant, concave up or concave down and finding any relative extrema or inflection points. Appropriately use these techniques to solve optimization problems.*
6. Determine when the Mean Value Theorem can be applied and use it in proofs of other theorems such as L'Hopital's rule.
7. Use differentials and linear approximations to analyze applied problems.
8. Determine antiderivatives, indefinite and definite integrals, use definite integrals to find areas of planar regions, use the Fundamental Theorems of Calculus, and integrate by substitution.*

6,7 are optional topics in Ohio Transfer Module.