

Outcomes and Objectives for Calculus I

At the end of the course the student will demonstrate:

Outcome 1: A conceptual and an practical understanding of the idea of a limit and the ability to use limits in several contexts.

Objectives:

1. Discuss the definition of the limit
2. Evaluate limits symbolically, numerically and graphically.
3. Explain the relationship between limits and other concepts, including continuity, differentiation, and integration.
4. Use l'Hopital's Rule to evaluate limits when possible.

Outcome 2: A conceptual and a practical understanding of differentiation in several contexts: graphically, numerically, analytically, and verbally (The Rule of Four).

Objectives:

1. Recognize that the difference quotient is used to interpret the meaning of average rate of change.
2. Define instantaneous rate of change as the limit of the difference quotient.
3. Generalize the idea of instantaneous rate of change to the derivative.
4. Understand the derivative as a function in its own right.
5. Demonstrate basic proficiency in differentiation and an understanding, in terms of the definition, of why the various differentiation rules are true.
6. Define continuity and analyze the connection between continuity and differentiability.
7. Interpret the meaning of the first and second derivatives in various applications.
8. Relate the global behavior of the derivative to the global behavior of the function.
9. Use the local linearity of the derivative function to obtain approximations.
10. Use local linearity to find limits.
11. Be able to use derivatives to solve applied problems.

Outcome 3: A conceptual and an practical understanding of, and ability to use, integration in several contexts: graphically, numerically, analytically, and verbally.

Objectives

1. Discuss the definite integral as a limit of Riemann sums.
2. Interpret the definite integral as total change (a number).
3. Interpret the indefinite integral as the general antiderivative, or as a family of functions.
4. Use the Fundamental Theorem of Calculus (FTC) to demonstrate that integration and differentiation are inverse processes.
5. Reconstruct an antiderivative by going "backward" from a derivative to the original function, first graphically and numerically, then analytically.
6. Use the Second Fundamental Theorem of Calculus (the "construction theorem for antiderivatives") to define and analyze an antiderivative function for a function that does not have an elementary antiderivative.