

## Learning Outcomes for Calculus I (Math 1910)

*Upon completion of the course, the student will be able to:*

1. interpret a function from an algebraic, numerical, graphical and verbal perspective and extract information relevant to the phenomenon modeled by the function.
2. verify the value of the limit of a function at a point using the definition of the limit
3. calculate the limit of a function at a point numerically and algebraically using appropriate techniques including l'Hospital's rule.
4. find points of discontinuity for functions and classify them.
5. understand the consequences of the intermediate value theorem for continuous functions
6. interpret the derivative of a function at a point as the instantaneous rate of change in the quantity modeled and state its units.
7. interpret the derivative of a function at a point as the slope of the tangent line and estimate its value from the graph of a function
8. sketch the graph of the derivative from the given graph of a function.
9. given a table of function values, approximate the value of the derivative at a point using the forward difference quotient and the centered difference quotient
10. compute the value of the derivative at a point algebraically using the (limit) definition
11. derive the expression for the derivative of elementary functions from the (limit) definition
12. be able to show whether a function is differentiable at a point.
13. compute the expression for the line tangent to a function at a point
14. interpret the tangent line geometrically as the local linearization of a function
15. compute the expression for the derivative of a function using the rules of differentiation including the power rule, product rule, and quotient rule and chain rule.
16. compute the expression for the derivative of a composite function using the chain rule of differentiation.
17. differentiate a relation implicitly and compute the line tangent to its graph at a point

18. differentiate exponential, logarithmic, and trigonometric and inverse trigonometric functions.
19. obtain expressions for higher order derivatives of a function using the rules of differentiation
20. interpret the value of the first and second derivative as measures of increase and concavity of a functions.
21. compute the critical points of a function on an interval.
22. identify the extrema of a function on an interval and classify them as minima , maxima or saddles using the first derivative test.
23. use the differential to determine the error of approximations.
24. understand the consequences of Rolle's theorem and the Mean Value theorem for differentiable functions
25. find the anti-derivative of elementary polynomials, exponential, logarithmic and trigonometric functions.
26. interpret the definite integral geometrically as the area under a curve
27. construct a definite integral as the limit of a Riemann sum
28. approximate a definite integral using left sum, right sum, midpoint and trapezoidal rules
29. interpret the indefinite integral as a definite integral with variable limit(s).
30. interpret differentiation and anti-differentiation as inverse operations (Fundamental Theorem of Calculus, part 1)
31. interpret the anti-derivative as a definite integral with variable limit and implement this expression on graphing platforms
32. evaluate a definite integral using an anti-derivative (Fundamental Theorem of Calculus, part 2)
33. use substitution to find the anti-derivative of a composite function.
34. apply basic optimization techniques to selected problems arising in various fields such as physical modeling , economics and population dynamics.