

Section 3.1 Tangents and the Derivative at a Point

- Understand that the slope of a secant line gives the average rate of change over an interval.
- Understand that the slope of a tangent line gives the instantaneous rate of change of a function.
- Be able to use the limit definition of the derivative to find the instantaneous rate of change of a function at a given point.
- Be able to use the limit definition of the derivative to find the slope of a tangent line.
- Know how to find the equation of a tangent line to a function at a specific point.

Section 3.2 The Derivative of a Function

- **Memorize** the formal limit definition of the derivative of a function (you do not need to learn the “alternative definition”).
- Know how to find the derivative of a given function using the formal definition.
- Understand differentiability on open and closed intervals, and be able to determine where a given function is differentiable.
- Be able to identify points where a function is **not** differentiable (vertical tangent lines, corners, and cusps).
- Understand and be able to compute right and left hand derivatives.
- Know that differentiable functions are continuous, but continuous functions may not be differentiable.
- Be able to sketch the graph of the derivative of a function given a graph of the function.
- Know the different forms of derivative notation discussed in class.

Section 3.3 Techniques of Differentiation

- Memorize and be able to apply differentiation formulas for constant functions, lines, and power functions.
- Memorize and be able to apply differentiation rules for sums, differences, products, and quotients of functions.
- Understand and be able to utilize the proofs of basic differentiation formulas.
- Understand the notation for and be able to compute higher order derivatives of a given function.

Section 3.4 The Derivative as a Rate of Change

- Be able to work basic applications of the derivative related to motion.
- Given a displacement function $s(t)$, be able to find and utilize $v(t)$, $a(t)$, and $j(t)$.
- Know the difference between velocity and speed.
- Be able to solve application problems involving motion and differentiation.

Section 3.5 Derivatives of Trigonometric Functions

- Memorize the differentiation formulas for all 6 basic trig functions.
- Be able to find equations for tangent lines to functions involving trigonometric functions.
- Know the proofs of trigonometric differentiation formulas.

Section 3.6 The Chain Rule

- Memorize the chain rule and be able to apply it to compute the derivative of a composite function.
- Be able to Combine the chain rule with other differentiation techniques.

Section 3.7 Implicit Differentiation

- Know the difference between implicit and explicit functions.
- Be able to find the derivative of a function that is defined implicitly.
- Be able to find equations for the tangent line to a point on an implicit curve.

Section 3.8 Related Rates

- Know the general method for solving related rates problems.
- Understand the connection between related rates and implicit differentiation.
- Be able to use related rates to compute rates of change and to solve application problems.

Section 3.9 Linearization and Differentials

- Be able to find the linearization of a differentiable function at a given point.
- Be able to use the linearization of a function find approximations.
- Know the definition of the differentials dx and dy .
- Be able to use differentials in order to find approximations.
- Be able to find the absolute and relative error in estimates found using linearization and differentials.