

# Midterm Review

This is a brief summary of concepts and type of questions that are important for your preparation of the midterm exam. Read the corresponding parts in textbook and lecture notes for detail.

## 1 Functions

1. Evaluate a function at a point
2. Find the domain and range of a function
3. Cartesian Coordinate System
4. Graph of functions, meaning of intersection of two graphs
5. Show a function is one-to-one
6. Find the inverse function of a given function, and find the domain and range of the inverse function
7. Graph of inverse function
8. Show a function is (strictly) increasing/decreasing by definition

## 2 Differentiation

1. Definition and computation rules of limit
2. Compute  $\lim_{x \rightarrow a} f(x)$
3. Definition of average rate of change, instant rate of change and relative rate of change

4. Marginal Cost
5. Definition of derivative  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ , and use the definition to compute the derivative
6. Find the slope of the graph of a function at  $x = a$  and find the corresponding equation of the tangent line
7. Basic Differentiation Rules
8. Addition, Subtraction, Multiplication and Quotient Rules of Differentiation
9. Use derivative to tell monotonicity, i.e. (strictly) increasing/decreasing
10. Chain Rule
11. Compute higher order derivatives
12. Definition of Convex and Concave functions, and find the intervals on which the given function is convex/concave
13. Definition of exponential and logarithmic functions and their basic properties
14. Derivatives of exponential and logarithmic functions
15. Logarithmic Differentiation and its applications in differentiation

### **3 Advanced Topics in Differentiation**

1. Implicit Differentiation
2. Find the slope and equation of the tangent line of a curve (equation) at a point  $(x, y) = (a, b)$
3. Second Order Implicit Differentiation
4. Inverse Differentiation
5. Find the slope and equation of the tangent line of the inverse function of a function at a point