Limit

1. Basic Knowledge of Limit
   1. the concept of limit
   2. Operation of limit
   3. Squeeze theorem
   4. Two important limits
   5. Infinitesimal and infinite large
   6. Function limit and infinitesimal
   7. Property of infinitesimal
   8. Comparison of infinitesimal
   9. Equivalent infinitesimal
2. Example
   1. Methods for computing limit
3. Apply four operation of limits
4. Apply two important limits
5. Apply squeeze theorem
6. Apply infinitesimal
7. 1. Comparison of infinitesimal

If find constant c and k, such that when , we have

* 1. Limit of piece-wise function
  2. limit with parameter function

Let

* 1. Definition of Limit

Function (1)

1. Basic Knowledge of Function
   1. Basic concepts of function

Mapping, domain, co-domain, range, graph, formula,

Six types of elementary function

* 1. Operation of functions and the domain of new function
  2. Monotone; even and odd
  3. Continuity of a function (at a point, at an interval)
     1. Concept of continuity (definition, left/right continuity)

* + 1. Computation of continuous function
    2. Properties of continuous function at a closed interval

1. Boundary
2. Absolute maxima and minima
3. Intermediate value theorem
4. Zero point theorem
5. Example
   1. Determine continuity of function
   2. Compute the limit based on the continuity

1. Let function continuous at x=0, find the constants of and .
   1. Properties of continuous function at a closed interval
2. Show equation at least has one real root at the interval (0,1).
3. Show any real coefficient polynomial function at least has one real root.

Concept of Derivatives

1. Basic knowledge of concept of derivatives.
   1. Definition of derivatives

As a limit and as a function

* 1. geometric interpretation and physical interpretation

Tangent line

Normal line

* 1. Left derivatives and right derivatives
  2. Differentiable and continuity

2 Example

2.1 Find derivatives by definition of derivatives

(1) Let continuous at x=0, and find .

(2) Let

2.2 Derivatives for piece-wise function

, find .

2.2 Derivatives for absolute function

Let , determine whether the function f is differentiable at the point x=0 or not.

* 1. Find limit based on definition of derivatives.

Let f(x) is differentiable at x=1, and f’(x)=-4. Find

* 1. Determine parameter based on the differentiable of a function

Let differentiable at x=0, find a, b.

* 1. Proof by definition of derivatives

Let f(x) differentiable at x=0, and , prove

* 1. Geometric application of derivatives

Find the equation of the tangent line to the curve with equation that through the point (0,0)

Computation of Derivatives

1. Basic Knowledge
   1. Differentiation formulas
2. Basic formulas
3. Four fundamental operations
4. Derivative of Inverse function
5. Derivative of compose function
6. Derivative of implicit function
   1. Higher derivatives

Definition and Leibniz formula

2 Example (By excises 6. )

2.1 Use differentiation formulas

2.2 Derivatives of piece-wise function

2.3 Derivatives of absolute function

2.4 Derivatives of implicit function

* 1. Derivatives with log function
  2. Higher derivatives

Mean Value Theorem

1. Basic Knowledge
   1. Rolle’s Theorem
   2. Lagrange Mean Value Theorem
   3. Cauchy’s Mean Value Theorem

1. Example
   1. Zero point of derivatives
2. Show that equation at least has one real root smaller than 1.
3. Exactly one real root.
   1. Equation with intermediate value

Let f(x) is continuous at [1,2], and it is differentiable at (1,2), and f(1)=1/2, f(2)=2. Show that there exists such that .

* 1. Equation with end points and intermediate value

Let f(x) is an odd function that differentiable everywhere, show that for any b>0, there exist such that .

* 1. Inequality

For function f(x), we have f’(x)<0 at [0,c] and f(0)=0. Show that for any constants a,b satisfy 0<a<b<a+b<c, we have f(a)+f(b)>f(a+b)

* 1. Equation with two intermediate values

Let f(x) is continuous at [0,1], and it is differentiable at (0,1), and f(0)=0, f(1)=1.

1. Show that there exists such that
2. Show that there exist , such that f’(k)f’(l)=1 .

Function (2)

1. Basic Knowledge
   1. Monotone
   2. Local Maxima and Local Minima
   3. Absolute Maxima and Absolute Minima