# AP Calculus AB

**Syllabus Checklist · 大纲自查表**

Tick one box per statement: ☐ not yet ☐ nearly ☐ confident. 每条打一个勾：尚未掌握 / 快会了 / 有把握。

## 1. Limits and Continuity 极限与连续性

### 1.1 Introducing Calculus: Can Change Occur at an Instant? 微积分引入：变化能在某一瞬间发生吗?

☐☐☐ Interpret the rate of change at an instant in terms of average rates of change over intervals containing that instant.

### 1.2 Defining Limits and Using Limit Notation 定义极限与使用极限记号

☐☐☐ Represent limits analytically using correct notation.

☐☐☐ Interpret limits expressed in analytic notation.

### 1.3 Estimating Limit Values from Graphs 从图像估计极限值

☐☐☐ Estimate limits of functions.

### 1.4 Estimating Limit Values from Tables 从表格估计极限值

☐☐☐ Estimate limits of functions.

### 1.5 Determining Limits Using Algebraic Properties of Limits 利用极限的代数性质求极限

☐☐☐ Determine the limits of functions using limit theorems.

### 1.6 Determining Limits Using Algebraic Manipulation 利用代数变形求极限

☐☐☐ Determine the limits of functions using equivalent expressions for the function or the squeeze theorem.

### 1.7 Selecting Procedures for Determining Limits 选择求极限的方法

☐☐☐ Selecting Procedures for Determining Limits

### 1.8 Determining Limits Using the Squeeze Theorem 利用夹逼定理求极限

☐☐☐ Determine the limits of functions using equivalent expressions for the function or the squeeze theorem.

### 1.9 Connecting Multiple Representations of Limits 联系极限的多种表示

☐☐☐ Connecting Multiple Representations of Limits

### 1.10 Exploring Types of Discontinuities 探究间断点的类型

☐☐☐ Justify conclusions about continuity at a point using the definition.

### 1.11 Defining Continuity at a Point 定义在某点的连续性

☐☐☐ Justify conclusions about continuity at a point using the definition.

**1.12 Confirming Continuity over an Interval** 确认区间上的连续性

☐☐☐ Determine intervals over which a function is continuous.

**1.13 Removing Discontinuities** 消除间断点

☐☐☐ Determine values of $x$ or solve for parameters that make discontinuous functions continuous, if possible.

**1.14 Connecting Infinite Limits and Vertical Asymptotes** 联系无穷极限与竖直渐近线

☐☐☐ Interpret the behavior of functions using limits involving infinity.

**1.15 Connecting Limits at Infinity and Horizontal Asymptotes** 联系无穷远处的极限与水平渐近线

☐☐☐ Interpret the behavior of functions using limits involving infinity.

**1.16 Working with the Intermediate Value Theorem (IVT)** 运用介值定理（IVT）

☐☐☐ Explain the behavior of a function on an interval using the Intermediate Value Theorem.

## 2. Differentiation: Definition and Fundamental Properties

微分：定义与基本性质

**2.1 Defining Average and Instantaneous Rates of Change at a Point** 定义某点的平均变化率与瞬时变化率

☐☐☐ Determine average rates of change using difference quotients.

☐☐☐ Represent the derivative of a function as the limit of a difference quotient.

**2.2 Defining the Derivative of a Function and Using Derivative Notation** 定义函数的导数与使用导数记号

☐☐☐ Represent the derivative of a function as the limit of a difference quotient.

☐☐☐ Determine the equation of a line tangent to a curve at a given point.

**2.3 Estimating Derivatives of a Function at a Point** 估计函数在某点的导数

☐☐☐ Estimate derivatives.

**2.4 Connecting Differentiability and Continuity: Determining When Derivatives Do and Do Not Exist** 联系可微性与连续性：判断导数何时存在与不存在

☐☐☐ Explain the relationship between differentiability and continuity.

**2.5 Applying the Power Rule** 应用幂法则

☐☐☐ Calculate derivatives of familiar functions.

**2.6 Derivative Rules: Constant, Sum, Difference, and Constant Multiple** 导数法则：常数、和、差与常数倍

☐☐☐ Calculate derivatives of familiar functions.

**2.7 Derivatives of cos x, sin x, e^x, and ln x** cos x、sin x、e^x 与 ln x 的导数

☐☐☐ Calculate derivatives of familiar functions.

☐☐☐ Interpret a limit as a definition of a derivative.

**2.8 The Product Rule** 乘积法则

☐☐☐ Calculate derivatives of products and quotients of differentiable functions.

**2.9 The Quotient Rule** 商法则

☐☐☐ Calculate derivatives of products and quotients of differentiable functions.

**2.10 Finding the Derivatives of Tangent, Cotangent, Secant, and/or Cosecant Functions** 求正切、余切、正割与余割函数的导数

☐☐☐ Calculate derivatives of products and quotients of differentiable functions.

## 3. Differentiation: Composite, Implicit, and Inverse Functions

微分：复合、隐式与反函数

**3.1 The Chain Rule** 链式法则

☐☐☐ Calculate derivatives of compositions of differentiable functions.

**3.2 Implicit Differentiation** 隐函数求导

☐☐☐ Calculate derivatives of implicitly defined functions.

**3.3 Differentiating Inverse Functions** 反函数求导

☐☐☐ Calculate derivatives of inverse and inverse trigonometric functions.

**3.4 Differentiating Inverse Trigonometric Functions** 反三角函数求导

☐☐☐ Calculate derivatives of inverse and inverse trigonometric functions.

**3.5 Selecting Procedures for Calculating Derivatives** 选择求导数的方法

☐☐☐ Selecting Procedures for Calculating Derivatives

**3.6 Calculating Higher-Order Derivatives** 计算高阶导数

☐☐☐ Determine higher order derivatives of a function.

## 4. Contextual Applications of Differentiation 微分在实际情境中的应用

**4.1 Interpreting the Meaning of the Derivative in Context** 在实际情境中解释导数的意义

☐☐☐ Interpret the meaning of a derivative in context.

**4.2 Straight-Line Motion: Connecting Position, Velocity, and Acceleration** 直线运动：联系位置、速度与加速度

☐☐☐ Calculate rates of change in applied contexts.

**4.3 Rates of Change in Applied Contexts Other Than Motion** 除运动之外的实际情境中的变化率

☐☐☐ Interpret rates of change in applied contexts.

**4.4 Introduction to Related Rates** 相关变化率引入

☐☐☐ Calculate related rates in applied contexts.

**4.5 Solving Related Rates Problems** 求解相关变化率问题

☐☐☐ Interpret related rates in applied contexts.

**4.6 Approximating Values of a Function Using Local Linearity and Linearization** 利用局部线性性与线性化近似函数值

☐☐☐ Approximate a value on a curve using the equation of a tangent line.

**4.7 Using L'Hospital's Rule for Determining Limits of Indeterminate Forms** 利用洛必达法则求不定型极限

☐☐☐ Determine limits of functions that result in indeterminate forms.

## 5. Analytical Applications of Differentiation 微分的分析性应用

**5.1 Using the Mean Value Theorem** 运用中值定理

☐☐☐ Justify conclusions about functions by applying the Mean Value Theorem over an interval.

**5.2 Extreme Value Theorem, Global Versus Local Extrema, and Critical Points** 极值定理、整体极值与局部极值以及临界点

☐☐☐ Justify conclusions about functions by applying the Extreme Value Theorem.

**5.3 Determining Intervals on Which a Function Is Increasing or Decreasing** 确定函数递增或递减的区间

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.4 Using the First Derivative Test to Determine Relative (Local) Extrema** 用一阶导数判别法确定相对（局部）极值

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.5 Using the Candidates Test to Determine Absolute (Global) Extrema** 用候选点判别法确定绝对（整体）极值

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.6 Determining Concavity of Functions over Their Domains** 确定函数在其定义域上的凹凸性

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.7 Using the Second Derivative Test to Determine Extrema** 用二阶导数判别法确定极值

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.8 Sketching Graphs of Functions and Their Derivatives** 绘制函数及其导数的图像

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.9 Connecting a Function, Its First Derivative, and Its Second Derivative** 联系函数、一阶导数与二阶导数

☐☐☐ Justify conclusions about the behavior of a function based on the behavior of its derivatives.

**5.10 Introduction to Optimization Problems** 最优化问题引入

☐☐☐ Calculate minimum and maximum values in applied contexts or analysis of functions.

**5.11 Solving Optimization Problems** 求解最优化问题

☐☐☐ Interpret minimum and maximum values calculated in applied contexts.

**5.12 Exploring Behaviors of Implicit Relations** 探究隐式关系的性态

☐☐☐ Determine critical points of implicit relations.

☐☐☐ Justify conclusions about the behavior of an implicitly defined function based on evidence from its derivatives.

## 6. Integration and Accumulation of Change 积分与变化的累积

**6.1 Exploring Accumulations of Change** 探究变化的累积

☐☐☐ Interpret the meaning of areas associated with the graph of a rate of change in context.

**6.2 Approximating Areas with Riemann Sums** 用黎曼和近似面积

☐☐☐ Approximate a definite integral using geometric and numerical methods.

**6.3 Riemann Sums, Summation Notation, and Definite Integral Notation** 黎曼和、求和记号与定积分记号

☐☐☐ Interpret the limiting case of the Riemann sum as a definite integral.

☐☐☐ Represent the limiting case of the Riemann sum as a definite integral.

**6.4 The Fundamental Theorem of Calculus and Accumulation Functions** 微积分基本定理与累积函数

☐☐☐ Represent accumulation functions using definite integrals.

**6.5 Interpreting the Behavior of Accumulation Functions Involving Area** 解释涉及面积的累积函数的性态

☐☐☐ Represent accumulation functions using definite integrals.

**6.6 Applying Properties of Definite Integrals** 应用定积分的性质

☐☐☐ Calculate a definite integral using areas and properties of definite integrals.

**6.7 The Fundamental Theorem of Calculus and Definite Integrals** 微积分基本定理与定积分

☐☐☐ Evaluate definite integrals analytically using the Fundamental Theorem of Calculus.

**6.8 Finding Antiderivatives and Indefinite Integrals: Basic Rules and Notation** 求原函数与不定积分：基本法则与记号

☐☐☐ Determine antiderivatives of functions and indefinite integrals, using knowledge of derivatives.

**6.9 Integrating Using Substitution** 用换元法积分

☐☐☐ For integrands requiring substitution or rearrangements into equivalent forms: (a) Determine indefinite integrals. (b) Evaluate definite integrals.

**6.10 Integrating Functions Using Long Division and Completing the Square** 用长除法与配方法积分

☐☐☐ For integrands requiring substitution or rearrangements into equivalent forms: (a) Determine indefinite integrals. (b) Evaluate definite integrals.

**6.14 Selecting Techniques for Antidifferentiation** 选择求原函数的方法

☐☐☐ Selecting Techniques for Antidifferentiation

## 7. Differential Equations 微分方程

**7.1 Modeling Situations with Differential Equations** 用微分方程为情境建模

☐☐☐ Interpret verbal statements of problems as differential equations involving a derivative expression.

**7.2 Verifying Solutions for Differential Equations** 验证微分方程的解

☐☐☐ Verify solutions to differential equations.

**7.3 Sketching Slope Fields** 绘制斜率场

☐☐☐ Estimate solutions to differential equations.

**7.4 Reasoning Using Slope Fields** 利用斜率场进行推理

☐☐☐ Estimate solutions to differential equations.

**7.6 Finding General Solutions Using Separation of Variables** 用分离变量法求通解

☐☐☐ Determine general solutions to differential equations.

**7.7 Finding Particular Solutions Using Initial Conditions and Separation of Variables** 用初始条件与分离变量法求特解

☐☐☐ Determine particular solutions to differential equations.

**7.8 Exponential Models with Differential Equations** 微分方程的指数模型

☐☐☐ Interpret the meaning of a differential equation and its variables in context.

☐☐☐ Determine general and particular solutions for problems involving differential equations in context.

## 8. Applications of Integration 积分的应用

**8.1 Finding the Average Value of a Function on an Interval** 求函数在区间上的平均值

- ☐☐☐ Determine the average value of a function using definite integrals.

**8.2 Connecting Position, Velocity, and Acceleration of Functions Using Integrals** 用积分联系函数的位置、速度与加速度

- ☐☐☐ Determine values for positions and rates of change using definite integrals in problems involving rectilinear motion.

**8.3 Using Accumulation Functions and Definite Integrals in Applied Contexts** 在实际情境中运用累积函数与定积分

- ☐☐☐ Interpret the meaning of a definite integral in accumulation problems.
- ☐☐☐ Determine net change using definite integrals in applied contexts.

**8.4 Finding the Area Between Curves Expressed as Functions of x** 求以 x 为自变量表示的曲线之间的面积

- ☐☐☐ Calculate areas in the plane using the definite integral.

**8.5 Finding the Area Between Curves Expressed as Functions of y** 求以 y 为自变量表示的曲线之间的面积

- ☐☐☐ Calculate areas in the plane using the definite integral.

**8.6 Finding the Area Between Curves That Intersect at More Than Two Points** 求相交多于两点的曲线之间的面积

- ☐☐☐ Calculate areas in the plane using the definite integral.

**8.7 Volumes with Cross Sections: Squares and Rectangles** 用横截面求体积：正方形与矩形

- ☐☐☐ Calculate volumes of solids with known cross sections using definite integrals.

**8.8 Volumes with Cross Sections: Triangles and Semicircles** 用横截面求体积：三角形与半圆

- ☐☐☐ Calculate volumes of solids with known cross sections using definite integrals.

**8.9 Volume with Disc Method: Revolving Around the x- or y-Axis** 圆盘法求体积：绕 x 轴或 y 轴旋转

- ☐☐☐ Calculate volumes of solids of revolution using definite integrals.

**8.10 Volume with Disc Method: Revolving Around Other Axes** 圆盘法求体积：绕其他轴旋转

- ☐☐☐ Calculate volumes of solids of revolution using definite integrals.

**8.11 Volume with Washer Method: Revolving Around the x- or y-Axis** 垫圈法求体积：绕 x 轴或 y 轴旋转

- ☐☐☐ Calculate volumes of solids of revolution using definite integrals.

**8.12 Volume with Washer Method: Revolving Around Other Axes** 垫圈法求体积：绕其他轴旋转

☐☐☐ Calculate volumes of solids of revolution using definite integrals.