

# My Notes for AP Calculus BC

Luke Barlow

2023-2024

# Contents

|          |  |          |
|----------|--|----------|
| <b>1</b> | <b>Limits and Continuity</b>                       | <b>3</b> |
| 1.1      | Computing Limits . . . . .                         | 3        |
| 1.2      | Limits at Infinity . . . . .                       | 3        |
| 1.3      | Continuity . . . . .                               | 3        |
| 1.4      | Intermediate Value Theorem . . . . .               | 3        |
| 1.5      | Squeeze Theorem . . . . .                          | 3        |
| <b>2</b> | <b>Differentiation and the Rate of Change</b>      | <b>4</b> |
| 2.1      | Tangent Lines and Rates of Change . . . . .        | 4        |
| 2.2      | The Derivative Function . . . . .                  | 4        |
| 2.3      | Techniques of Differentiation . . . . .            | 4        |
| 2.4      | Product Rule and Quotient Rule . . . . .           | 4        |
| 2.5      | Derivatives of Trig Functions . . . . .            | 4        |
| 2.6      | The Chain Rule . . . . .                           | 4        |
| <b>3</b> | <b>Topics in Differentiation</b>                   | <b>5</b> |
| 3.1      | Implicit Differentiation . . . . .                 | 5        |
| 3.2      | Derivatives of Logarithmic Functions . . . . .     | 5        |
| 3.3      | Derivatives of Exponential Functions . . . . .     | 5        |
| 3.4      | Derivatives of Inverse Functions . . . . .         | 5        |
| 3.5      | Related Rates . . . . .                            | 5        |
| 3.6      | Local Linear Approximation . . . . .               | 5        |
| 3.7      | L'Hôpital's Rule and Indeterminate Forms . . . . . | 5        |
| <b>4</b> | <b>The Derivative in Graphing and Applications</b> | <b>6</b> |
| 4.1      | Increase, Decrease, and Concavity . . . . .        | 6        |
| 4.2      | Relative Extrema . . . . .                         | 6        |
| 4.3      | Absolute Maxima and Minima . . . . .               | 6        |
| 4.4      | Applied Max and Min Problems . . . . .             | 6        |
| 4.5      | Rectilinear Motion . . . . .                       | 6        |
| 4.6      | Mean Value Theorem . . . . .                       | 6        |

|           |  |           |
|-----------|--|-----------|
| <b>5</b>  | <b>Integration</b>   | <b>7</b>  |
| 5.1       | Overview of Area . . . . .                                       | 7         |
| 5.2       | The Indefinite Integral . . . . .                                | 7         |
| 5.3       | Slope Fields . . . . .   | 7         |
| 5.4       | Integration By Substitution . . . . .                            | 7         |
| 5.5       | Area as a Limit and Riemann Sums . . . . .                       | 7         |
| 5.6       | Exact Area Under a Curve (Trapezoid Rule) . . . . .              | 7         |
| 5.7       | The Definite Integral . . . . .                                  | 7         |
| 5.8       | The Accumulation Function . . . . .                              | 7         |
| 5.9       | The Fundamental Theorem of Calculus . . . . .                    | 7         |
| 5.10      | Total Change Theorem . . . . .                                   | 7         |
| 5.11      | Average Value . . . . .  | 7         |
| 5.12      | Definite Integrals by Substitution . . . . .                     | 7         |
| <b>6</b>  | <b>Applications of the Definite Integral</b>                     | <b>8</b>  |
| 6.1       | Area Between Two Curves . . . . .                                | 8         |
| 6.2       | Volumes by Slicing . . . . .                                     | 8         |
| 6.3       | Disks and Washers . . . . .                                      | 8         |
| 6.4       | Length of a Plane Curve . . . . .                                | 8         |
| <b>7</b>  | <b>Principles of Integral Evaluation</b>                         | <b>9</b>  |
| 7.1       | Integration by Parts . . . . .                                   | 9         |
| 7.2       | Integration of Rational Functions by Partial Fractions . . . . . | 9         |
| 7.3       | Improper Integrals . . . . .                                     | 9         |
| <b>8</b>  | <b>Differential Equations</b>                                    | <b>10</b> |
| 8.1       | Logistic Growth . . . . .  | 10        |
| 8.2       | Separable Equations . . . . .                                    | 10        |
| 8.3       | Exponential Growth and Decay . . . . .                           | 10        |
| 8.4       | Euler's Method . . . . .   | 10        |
| <b>9</b>  | <b>Infinite Series</b>   | <b>11</b> |
| 9.1       | Defining Convergent and Divergent Infinite Series . . . . .      | 11        |
| 9.2       | Geometric Series . . . . .                                       | 11        |
| 9.3       | nth Term Test . . . . .  | 11        |
| 9.4       | Integral Test . . . . .  | 11        |
| 9.5       | p-series and Harmonic Series . . . . .                           | 11        |
| 9.6       | Comparison Tests . . . . .                                       | 11        |
| 9.7       | Polynomial Test . . . . .  | 11        |
| 9.8       | Alternating Series . . . . .                                     | 11        |
| <b>10</b> | <b>Parametric, Polar, and Vector-Valued Functions</b>            | <b>12</b> |
| 10.1      | Parametric Equations . . . . .                                   | 12        |
| 10.2      | Vector-Valued Functions . . . . .                                | 12        |
| 10.3      | Polar Functions . . . . .  | 12        |

## Chapter 1

# Limits and Continuity

1.1 Computing Limits

1.2 Limits at Infinity

1.3 Continuity

1.4 Intermediate Value Theorem

1.5 Squeeze Theorem

## Chapter 2

# Differentiation and the Rate of Change

2.1 Tangent Lines and Rates of Change

2.2 The Derivative Function

2.3 Techniques of Differentiation

2.4 Product Rule and Quotient Rule

2.5 Derivatives of Trig Functions

2.6 The Chain Rule

## Chapter 3

# Topics in Differentiation

3.1 Implicit Differentiation

3.2 Derivatives of Logarithmic Functions

3.3 Derivatives of Exponential Functions

3.4 Derivatives of Inverse Functions

3.5 Related Rates

3.6 Local Linear Approximation

3.7 L'Hôpital's Rule and Indeterminate Forms

## Chapter 4

# The Derivative in Graphing and Applications

4.1 Increase, Decrease, and Concavity

4.2 Relative Extrema

4.3 Absolute Maxima and Minima

4.4 Applied Max and Min Problems

4.5 Rectilinear Motion

4.6 Mean Value Theorem

## Chapter 5

# Integration

5.1 Overview of Area

5.2 The Indefinite Integral

5.3 Slope Fields

5.4 Integration By Substitution

5.5 Area as a Limit and Riemann Sums

5.6 Exact Area Under a Curve (Trapezoid Rule)

5.7 The Definite Integral

5.8 The Accumulation Function

5.9 The Fundamental Theorem of Calculus

5.10 Total Change Theorem

5.11 Average Value

5.12 Definite Integrals by Substitution



## Chapter 6

# Applications of the Definite Integral

6.1 Area Between Two Curves

6.2 Volumes by Slicing

6.3 Disks and Washers

6.4 Length of a Plane Curve

## Chapter 7

# Principles of Integral Evaluation

7.1 Integration by Parts

7.2 Integration of Rational Functions by Partial  
Fractions

7.3 Improper Integrals

## Chapter 8

# Differential Equations

8.1 Logistic Growth

8.2 Separable Equations

8.3 Exponential Growth and Decay

8.4 Euler's Method

## Chapter 9

# Infinite Series

9.1 Defining Convergent and Divergent Infinite Series

9.2 Geometric Series

9.3  $n$ th Term Test

9.4 Integral Test

9.5  $p$ -series and Harmonic Series

9.6 Comparison Tests

9.7 Polynomial Test

9.8 Alternating Series

## Chapter 10

# Parametric, Polar, and Vector-Valued Functions

10.1 Parametric Equations

10.2 Vector-Valued Functions

10.3 Polar Functions