

BASIC CALCULUS

for Senior High School

REVISED EDITION

Perla S. dela Cruz
Lea D. Maderal
Ma. Theresa Christine C. Valdez

BASIC CALCULUS

for Senior High School

REVISED EDITION

Perla S. dela Cruz

Lea D. Maderal

Ma. Theresa Christine C. Valdez



C & E Publishing, Inc.
2022

TABLE OF CONTENTS

Dedication	VII
------------------	-----

Preface	IX
---------------	----

1 Limits and Continuity

Lesson 1 Limit of a Function	2
------------------------------------	---

Lesson 2 Evaluating Limits	13
----------------------------------	----

Lesson 3 Limits of Algebraic Functions	24
--	----

Lesson 4 Limits of Exponential, Logarithmic, and Trigonometric Functions	53
---	----

Lesson 5 Continuity of a Function	70
---	----

2 Basic Concepts of Derivatives and Its Applications

Lesson 1 The Slope of the Tangent Line	94
--	----

Lesson 2 The Slope of the Tangent Line and Derivative of a Function	101
---	-----

Lesson 3 Differentiation Rules	114
--------------------------------------	-----

Lesson 4 Extreme Values and Optimization	138
--	-----

Lesson 5 Higher-Order Derivatives and Rectilinear Motion	156
--	-----

Lesson 6 The Chain Rule	163
-------------------------------	-----

Lesson 7 Implicit Differentiation and Related Rates	171
---	-----

3 Antiderivatives and Indefinite Integration

Lesson 1	Antiderivatives and Indefinite Integrals	196
Lesson 2	Integration by Substitution	207
Lesson 3	Applications of the Indefinite Integral	225

4 The Definite Integral and Its Applications

Lesson 1	Area Approximation by Riemann Sums and the Definite Integrals	252
Lesson 2	The Fundamental Theorem of Calculus and the Substitution Rule	279
Lesson 3	Areas of Plane Regions	288

Summary of Formulas	306
---------------------------	------------

Glossary	317
----------------	------------

Index	322
-------------	------------

Bibliography	324
--------------------	------------

A

- antidifferentiation, 197
 - change of variables, 209
 - composite function, 210
 - pattern recognition, 207

area, 258, 263

- approximations, 258
- between two curves, 289
- under a curve, 265

C

- chain rule, 163
 - exponential functions, 167
 - general power rule, 166
 - inverse trigonometric functions, 175
 - logarithmic functions, 177
 - trigonometric functions, 167

continuity, 70

- closed intervals, 76
- definition, 72
- open intervals, 76
- properties of, 75

critical number, 139

D

decay model, 238

definite integral, 266

- change of variable, 283
- properties, 271
- substitution rule, 283

derivatives, 102

- algebraic functions, 114
- composite function, 163
- function, 102
- general exponential functions, 130
- higher order, 156
- inverse trigonometric functions, 175
- logarithmic functions, 177
- natural exponential functions, 128
- trigonometric functions, 131

differential equations, 227

- separable, 228

differentiability, 111

differentiation, 114

- constant multiple rule, 117
- constant rule, 114
- implicit, 171
- power rule, 115
- product rule, 120
- quotient rule, 122
- sum and difference rule, 118

discontinuity, 71

- types, 78

E

exponential growth, 238

extreme values, 138

- applications of, 145
- maximum value, 138
- minimum value, 139

Extreme Value Theorem, 83

F

Fundamental Theorem of Calculus, 279

I

indefinite integral, 197

applications of, 225

properties of, 201

integration, 197

general power rule, 215

rules of, 198

trigonometric functions, 199

upgraded rules, 219

Intermediate Value Theorem, 81

L

limits, 1

constant multiple, 16

definition, 6

evaluation, 13

exponential and logarithmic functions, 55

existence, 33

infinite, 38

infinity, at, 42

laws, 15

one-sided, 32

piecewise functions, 30

polynomial functions, 24

power, 19

product, 18

quotient, 18

radical, 19

radical functions, 29

rational functions, 25

sum and difference, 17

trigonometric functions, 56

O

optimization, 141

R

rate of change, 107

average, 108

instantaneous, 110

rectilinear motion, 152

related rates, 182

applications of, 182

Riemann sum, 263

S

summation, 252

formulas, 255

notation, 252

properties of, 254

T

tangent line, 94

slope of, 96