

Table of Contents

1. The Derivative	5
1.1 Introduction to the Derivative	5
1.2 Functions, Functional Notation and Limits.....	8
1.3 Calculating Derivatives from Basic Principles: The Delta Method	11
Answers, Chapter 1 – The Derivative	13
2. Calculating Derivatives	15
2.1 The Differentiation Operator	15
2.2 The Basic Rules of Differentiation	15
2.3 The Product Rule	17
2.4 The Quotient Rule.....	19
2.5 Composite Functions and the Chain Rule.....	20
2.6 Combining the Differentiation Rules.....	22
2.7 Higher Derivatives.....	24
2.8 Implicit Differentiation	25
2.9 A Word on Notation	28
Answers, Chapter 2 – Calculating Derivatives	30
3. Applications of Derivatives	33
3.1 Motion in One Dimension	33
3.2 Electricity.....	35
3.3 Curve Sketching.....	42
3.4 Applied Max/Min (Optimization) Problems	48
3.5 Related Rates	51
3.6 The Newton-Raphson Method.....	57
3.7 Waveform Differentiation.....	61
Answers, Chapter 3 – Applications of Derivatives.....	65
4. Differentials	69
4.1 The Definition and Notation of Differentials.....	69
4.2 Related Changes.....	70
4.3 Expressing Changes in Relative or Percent Form.....	73
4.4 Error Analysis	75
4.5 More on the Notation of Differentials.....	76
Answers, Chapter 4 – Differentials	79
5. Indefinite Integrals	81
5.1 Definition and Notation	81
5.2 The Basic Rules of Integration.....	82
5.3 Fixing the Integration Constant	84
5.4 The Electrical Formulas in Integral Form	85
5.5 Indefinite Integration Of Piecewise Continuous Functions	89
5.6 Indefinite Integration Of Waveforms.....	93
Answers, Chapter 5 – Indefinite Integrals	97

6. Definite Integrals and Area Under the Curve.....	99
6.1 Computing the Area Under A Curve	99
6.2 Computing the Area Between Curves.....	106
6.3 Definite Integrals with Variable Upper Limits	110
6.4 The Notation for Definite Integrals.....	116
6.5 Numerical Integration	116
6.6 Improper Integrals.....	124
6.7 The Mean and RMS Values of a Function.....	124
Answers, Chapter 6 – Definite Integrals and Area Under the Curve.....	135
7. Derivatives and Integrals Of The Elementary Functions	137
7.1 The Derivatives of e^x and $\sin x$	137
7.2 Derivatives of the logarithm and trigonometric functions	139
7.3 More Derivatives	144
7.4 Integrals of the trigonometric, exponential and logarithmic functions	147
7.5 Application Examples	150
Answers, Chapter 7 – The Elementary Functions.....	159
8. Integration Methods	163
8.1 The Table Look-up Method	165
8.2 The Substitution or Change Of Variable Method	166
8.3 The Trigonometric Identity Method	172
8.4 The Trigonometric Substitution Method.....	178
8.5 Integration By Parts	182
8.6 Partial Fractions Decomposition.....	187
8.7 Integration Using Complex Arithmetic.....	196
Answers, Chapter 8 – Integration Methods	199
9. Maclaurin and Taylor Series	203
9.1 Introduction.....	203
9.2 Maclaurin Series	206
9.3 List of Important Maclaurin Series	211
9.4 Some Properties of Maclaurin Series.....	212
9.5 Taylor Series	215
9.6 The Error of the Series.....	219
9.7 Applications of Maclaurin Series.....	223
Answers, Chapter 9 – MacLaurin and Taylor Series	232
10. Fourier Series	233
10.1 Introduction.....	233
10.2 Definition of the Fourier Series	235
10.3 The Spectrum of a Waveform.....	247
10.4 The Power Spectrum.....	250
10.5 Transformations	253
10.5 Applications and Extensions of Fourier Series	263
Answers, Chapter 10 – Fourier Series	286
Appendix A. Curve Sketching Basics.....	289
Appendix B. Table of Integrals.....	295
Appendix C. Table of Derivatives	299