

Table of Contents

Chapter 11 - More Derivatives

11.1	Review of the derivative	11-3
11.1.1	Rates of change	11-3
11.1.2	First principles	11-4
11.1.3	The derivative by rule	11-6
11.2	Applications of the derivative	11-9
11.2.1	Curve sketching	11-9
11.2.2	Review of optimisation	11-13
11.3	Chain rule	11-16
11.3.1	Review of composite functions	11-16
11.3.2	Derivative of composites	11-17
11.4	Product rule	11-25
11.5	Putting it all together	11-29
11.6	The anti-derivative	11-30
11.6.1	By inspection	11-31
11.6.2	Tangent field	11-34
11.6.3	Exact anti-derivative	11-40
11.6.4	Applications of the integral	11-42

Chapter 12 - Numerical Integration

12.1	Areas under graphs	12-3
12.1.1	Areas and dimensions	12-3
12.1.2	Summing areas	12-5
12.1.3	Estimating areas of functions	12-9
12.2	Trapezoidal rule	12-12
12.2.1	The method	12-12
12.2.2	The rule	12-15
12.3	Modelling with areas	12-18
12.3.1	Modelling automobile travel	12-18
12.3.2	Modelling pollution control	12-20
12.3.3	Modelling volumes	12-22

Chapter 13 - Algebraic Integration

13.1	Review of primitive functions	13-3
13.1.1	Primitives from graphs	13-4
13.1.2	Primitives from tangent fields	13-5
13.1.3	Primitives by inspection	13-6
13.2	The integral and area	13-7
13.2.1	Constant functions	13-7
13.2.2	Linear functions	13-9
13.2.3	Quadratic functions	13-11
13.2.4	The equation for $A(x)$	13-14
13.3	Integration terminology	13-16
13.3.1	The fundamental theorem	13-17
13.3.2	Integration rules	13-18
13.3.3	Negative areas	13-21
13.4	Applying the definite Integral	13-25
13.4.1	Motion	13-25
13.4.2	Economics	13-26
13.4.3	Average value	13-27

Chapter 14 - More Periodic Models

14.1	Review of periodic functions	14-3
14.2	Rate of Change	14-7
14.2.1	The Ferris wheel re-visited	14-7
14.2.2	Derivative of $\sin x^\circ$, $\cos x^\circ$	14-9
14.3	Radian measure	14-12
14.3.1	A new measure of angle	14-12
14.3.2	Definition for the radian	14-14
14.3.3	Conversions and radian	14-15
14.3.4	Special conversions	14-16
14.3.5	Using radian mode	14-17
14.3.6	Symmetry relationships	14-18
14.4	Periodic models using radians	14-21
14.5	The derivative using radians	14-24
14.5.1	The derivative of $\sin x^c$	14-24
14.5.2	The derivative of $\cos x^c$	14-25
14.5.3	The derivative of $\sin x + D$	14-26
14.5.4	The derivative of $A \sin x$	14-27
14.5.5	The derivative of $\sin(Bx)$	14-28
14.5.6	The derivative of $\sin(x + C)$	14-29
14.5.7	Derivative of $A \sin(Bx + C) + D$	14-31
14.6	Modelling periodic rates	14-34
14.6.1	The Ferris wheel re-visited	14-34
14.7	Integrating periodic functions	14-39
14.7.1	Indefinite integral	14-39
14.7.2	Definite integral	14-42

Chapter 15 - Modelling Exponential Growth

15.1	Review of exponentials	15-3
15.1.1	Exponent and logarithm laws	15-3
15.1.2	An example	15-3
15.2	Modelling financial situations	15-8
15.2.1	Review of compound interest	15-8
15.2.2	Annuities	15-11
15.2.3	Amortising loans	15-17
15.2.4	Continuous compounding	15-17
15.3	The derivative of exponentials	15-20
15.3.1	The derivative of $f(x) = a^x$	15-20
15.3.2	A special derivative	15-23
15.3.3	The derivative of $f(x) = a \times e^{bx}$	15-25
15.4	The integral of exponentials	15-28
15.5	Modelling with exponentials	15-30
15.5.1	Population growth	15-31
15.5.2	Radioactive decay	15-31
15.5.3	Rate of cooling	15-33

Chapter 16 - Modelling Logarithmic Growth

16.1	Review of logarithms	16-3
16.1.1	Exponent and logarithm laws	16-3
16.1.2	An example	16-3
16.2	Review of linear functions	16-7
16.2.1	Properties of linear functions	16-7
16.2.2	Modelling with linear functions	16-8
16.3	Modelling using logarithms	16-10
16.3.1	Modelling power functions	16-11
16.3.2	Modelling exponential functions	16-13
16.4	The derivative of logarithms	16-17
16.4.1	The derivative of $f(x) = \ln x$	16-17
16.4.2	The derivative of $f(x) = a \times \ln kx$	16-20
16.4.3	Simplifying the chain rule	16-22
16.5	The integral of $\frac{1}{x}$	16-24
16.6	Digital analysis	16-27
16.6.1	Logarithm tables	16-28
16.6.2	Benford's Law	16-30
16.6.3	Benford's Law illustrated	16-32
16.6.4	Digital analysis	16-33

Chapter 17 - Areas and graphs

17.1	Curve sketching	17-3
17.1.1	Rates of change and graphs	17-3
17.1.2	Polynomial sketches	17-5
17.1.3	Concavity/second derivative	17-10
17.1.4	Discontinuous functions	17-16
17.1.5	Trigonometric functions	17-23
17.2	Equations of tangents	17-26
17.3	Areas between curves	17-27
17.3.1	Areas under polynomials	17-27
17.3.2	Areas under other functions	17-29
17.3.3	Areas between curves	17-31
17.4	Applications of areas	17-37
17.4.1	Economics	17-37
17.4.2	Engineering	17-40

Chapter 18 - Optimisation

18.1	Review of modelling	18-3
18.2	Optimising numerical situations	18-5
18.3	Optimising areas	18-7
18.4	Optimising volumes	18-11
18.5	Optimising distance and time	18-16
18.6	Miscellaneous optimisation	18-19

Chapter 19 - Making Inferences from Data

19.1	Review of binomial distribution	19-3
19.1.1	Probability distributions	19-3
19.1.2	Discrete random variables	19-5
19.1.3	Expected value	19-6
19.1.4	Binomial distribution	19-7
19.2	From discrete to continuous data	19-11
19.2.1	Large binomial distributions	19-11
19.2.2	Density curves	19-15
19.3	The Normal distribution	19-17
19.3.1	Standardising data	19-17
19.3.2	Standard Normal equation	19-20
19.3.3	The equation of the Normal	19-21
19.3.4	Area of continuous variables	19-21
19.3.5	Normal probability and technology	19-23
19.3.6	Standard Normal tables	19-24