

Specialist Mathematics Units 3 & 4

Contents

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Series contents

This series comprises **twelve content workbooks**, cumulative **topic tests**, and a **practice-examination booklet**, covering the complete VCAA Specialist Mathematics Units 3 & 4 course. Each content workbook follows the same structure: concise theory, scaffolded and unscaffolded worked examples, graded practice questions, a compact answer key, and fully-worked solutions.

Discrete mathematics

Chapter 1 — Logic and proof (67 pp)

1A Direct proof, cases, contradiction and contrapositive · 1B Quantifiers and counterexamples · 1C Proving inequalities · 1D Telescoping sums and series · 1E Proof by mathematical induction · 1F Algorithms and pseudocode

Topic 1 Test A (technology-active) and Test B (technology-free), with fully-worked solutions, are included at the end of this workbook.

Space and measurement — vectors

Chapter 2 — Vectors (48 pp)

2A Vectors and vector operations · 2B Components, magnitude and unit vectors · 2C The scalar (dot) product · 2D Scalar and vector resolutes · 2E Linear dependence, independence and collinearity · 2F Vector proofs of geometric results

Chapter 3 — Vector equations of lines and planes (41 pp)

3A Vector equations of lines · 3B Intersecting, parallel and skew lines · 3C The vector (cross) product · 3D Equations of planes · 3E Distances, angles and intersections

Algebra, number and structure

Chapter 4 — Complex numbers (73 pp)

4A Complex numbers in Cartesian form · 4B The conjugate, modulus and division · 4C Polar form of a complex number · 4D Multiplication and division in polar form · 4E Quadratic equations over the complex numbers · 4F Polynomial equations over the complex numbers · 4G De Moivre's theorem, powers and roots · 4H Regions of the complex plane

Topic 2 Test A (technology-active) and Test B (technology-free), with fully-worked solutions, are included at the end of this workbook.

Calculus

Chapter 5 — Differentiation and rational functions (73 pp)

5A The derivative and graphs of related functions · 5B Derivatives of $x = f(y)$ · 5C Derivatives of inverse circular functions · 5D Second derivatives · 5E Concavity and points of inflection · 5F Related rates · 5G Graphs of rational functions · 5H Implicit differentiation

Chapter 6 — Techniques of integration (69 pp)

6A Antidifferentiation · 6B Antiderivatives giving inverse circular functions · 6C Integration by substitution · 6D Definite integrals by substitution · 6E Trigonometric identities in integration · 6F Harder substitutions · 6G Integration using partial fractions · 6H Integration by parts

Chapter 7 — Applications of integration (61 pp)

7A The fundamental theorem of calculus · 7B Areas of regions bounded by curves · 7C Numerical and technology-assisted integration · 7D Volumes of solids of revolution · 7E Lengths of curves · 7F Areas of surfaces of revolution

Chapter 8 — Differential equations (102 pp)

8A Introduction to differential equations · 8B Differential equations of the form $dy/dx = f(x)$ · 8C Differential equations of the form $dy/dx = f(y)$ · 8D Applications of differential equations · 8E The logistic differential equation · 8F Separation of variables · 8G Differential equations and related rates · 8H Using a definite integral to solve a differential equation · 8I Euler's method · 8J Slope fields

Chapter 9 — Kinematics (62 pp)

9A Position, velocity and acceleration · 9B Constant acceleration · 9C Velocity–time graphs · 9D Differential equations of the form $v = f(x)$ and $a = f(v)$ · 9E Other expressions for acceleration

Topic 4 Test A (technology-active) and Test B (technology-free), with fully-worked solutions, are included at the end of this workbook.

Space and measurement — vector calculus

Chapter 10 — Vector functions and vector calculus (48 pp)

10A Vector functions and their paths · 10B Position vectors as a function of time · 10C Differentiating and antidifferentiating vector functions · 10D Velocity and acceleration for motion in a plane and in space

Topic 3 Test A (technology-active) and Test B (technology-free), with fully-worked solutions, are included at the end of this workbook.

Data analysis, probability and statistics

Chapter 11 — Linear combinations of random variables and the sample mean (57 pp)

11A Linear functions of a random variable · 11B Linear combinations of random variables · 11C Linear combinations of normal random variables · 11D The sample mean of a normal random variable · 11E Investigating the distribution of the sample mean using simulation · 11F The distribution of the sample mean

Chapter 12 — Confidence intervals and hypothesis testing for the mean (59 pp)

12A Confidence intervals for the population mean · 12B Hypothesis testing for the mean · 12C One-tail and two-tail tests · 12D Two-tail tests and confidence intervals · 12E Errors in hypothesis testing

Topic 5 Test A (technology-active) and Test B (technology-free), with fully-worked solutions, are included at the end of this workbook.

Practice examinations

Chapter 13 — Practice Examinations (80 pp)

Six full practice examinations with fully-worked solutions, cumulative over the whole course:

Practice Exams 1–3 — Technology-free (Exam 1 style: 40 marks, 1 hour writing, short-answer), at increasing difficulty · Practice Exams 4–6 — Technology-active (Exam 2 style: 80 marks = Section A 20 multiple-choice + Section B extended-response, 2 hours writing), at increasing difficulty. A formula sheet is provided with each examination.

The series comprises ≈ 843 pages across all booklets.