

On Track 4

Mathematics Workbook

W. Geldof

Written for Year 12 students studying any NCEA Level 2 course
in Applied Mathematics or Statistics

© W. Geldof 2020

© Sigma Publications Ltd. 2020

1st Edition



This book is copyright.

Under the Copyright Act 1994, no part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher or its agent.

Licences for limited reprographic reproduction by educational institutions may be obtained from
Copyright Licensing Limited,
P.O. Box 33-1488, Takapuna 0740,
North Shore City, New Zealand
Ph 0800 480 271

Printed and bound in Malaysia through
Bookpac Production Services, Singapore.

Published by Sigma Publications Ltd
P.O. Box 15-248 Tauranga 3144, New Zealand
Phone 0800 274 462, Fax 0800 274 460
Email : mail@sigmapublications.co.nz
Website : www.sigmapublications.co.nz

The logo for Sigma Publications, featuring a stylized sigma symbol (σ) inside a circle, followed by the word "sigma" in a bold, lowercase sans-serif font, and the word "PUBLICATIONS" in a smaller, uppercase sans-serif font below it.

ISBN 978-1-877567-14-8

AS 2.1 - Coordinate Geometry

Internal Assessment - 2 credits

| | |
|---|----|
| Using Grid Paper | 5 |
| Line Segments | 6 |
| Gradient | 7 |
| Drawing Straight Lines | 8 |
| Points on a Line | 9 |
| Writing Equations 1 | 10 |
| Writing Equations 2 | 11 |
| Parallel and Perpendicular Lines | 12 |
| Intersections | 13 |
| Skills Practice | 14 |
| Linear Modelling 1 | 15 |
| Linear Modelling 2 | 16 |
| Location | 17 |
| AS 2.1 - Coordinate Geometry - Test | 18 |

AS 2.2 - Graphical Methods

Internal Assessment - 4 credits

| | |
|--|---------|
| Introduction to Graphical Methods 1 | 19 |
| Introduction to Graphical Methods 2 | 20 |
| Plotting Graphs | 21 |
| Polynomials [Degree 1] | 22 |
| Polynomials [Degree 2] | 23 & 24 |
| Polynomials [Degree 3] | 25 |
| Rectangular Hyperbolas 1 | 26 |
| Rectangular Hyperbolas 2 | 27 |
| Exponential Curves | 28 |
| Logarithmic Curves | 29 |
| Mixed Graphs | 30 |
| Domain and Range of Functions | 31 |
| Piecewise Functions | 32 |
| Solving Problems 1 | 33 |
| Solving Problems 2 | 34 |
| Solving Problems 3 | 35 |
| Graphing Trig Functions 1 | 36 |
| Graphing Trig Functions 2 | 37 |
| Graphing Trig Functions 3 | 38 |
| Writing Equations for Trig Functions 1 | 39 |
| Writing Equations for Trig Functions 2 | 40 |
| Solving Trig Equations with a GC | 41 |
| Modelling with Trig Functions | 42 |
| AS 2.2 - Graphical Methods - Test | 43 & 44 |

AS 2.3 - Sequences and Series

Internal Assessment - 2 credits

| | |
|--|----|
| Terms of an AP - 1 | 45 |
| Terms of an AP - 2 | 46 |
| Sum of a AP | 47 |
| APs in Context 1 | 48 |
| Examples Using Technology | 49 |
| APs in Context 2 | 50 |
| Terms of a GP - 1 | 51 |
| Terms of a GP - 2 | 52 |
| Sum of a GP | 53 |
| GPs in Context 1 | 54 |
| GPs in Context 2 | 55 |
| Sum to Infinity | 56 |
| GPs in Context 3 | 57 |
| Mixed Problems, APs and GPs | 58 |
| AS 2.3 - Sequences and Series - Test | 59 |

AS 2.4 - Trigonometry

Internal Assessment - 3 credits

| | |
|------------------------------------|----|
| Right-Angled Triangles 1 | 60 |
| Right-Angled Triangles 2 | 61 |
| The Area Rule 1 | 62 |
| The Area Rule 2 | 63 |
| The Sine Rule 1 | 64 |
| The Sine Rule 2 | 65 |
| The Cosine Rule 1 | 66 |
| The Cosine Rule 2 | 67 |
| Mixed Problems 1 | 68 |
| Mixed Problems 2 | 69 |
| Mixed Problems 3 | 70 |
| Radians | 71 |
| Sectors and Arcs 1 | 72 |
| Sectors and Arcs 2 | 73 |
| Surveying | 74 |
| Navigation | 75 |
| AS 2.4 - Trigonometry - Test | 76 |

AS 2.5 - Networks

Internal Assessment - 2 credits

| | |
|-------------------------------------|----|
| Introduction to Networks | 77 |
| Traversability 1 | 78 |
| Traversability 2 | 79 |
| Visiting All Nodes Once | 80 |
| Weighted Networks | 81 |
| Minimum Spanning Tree | 82 |
| From Spanning Tree to Circuit | 83 |

Introduction

AS 2.5 - continued

Finding the Shortest Path 184
 Finding the Shortest Path 285
 Finding the Shortest Path 386
 Solving Problems 187
 Solving Problems 288
 Solving Problems 389
 Solving Problems 490
 AS 2.5 - Networks - Test91 & 92

General Statistics Chapter - AS 2.8, 2.9, 2.10 & 2.11
[Complete if sitting any of the above standards.]

Statistical Enquiry Cycle93
 Populations and Samples94
 Non-Sampling Error95
 Sample Statistics 196
 Sample Statistics 297
 Sample Statistics 398
 Calculating Statistics with a GC99
 Shape of a Distribution 1100
 Shape of a Distribution 2101
 Sampling Error 1102
 Sampling Error 2103
 Statistical Vocabulary104

AS 2.8 - Design a Questionnaire

Internal Assessment - 3 credits

A Process Overview105
 Define the Objectives 1106
 Define the Objectives 2107
 Define the Objectives 3108
 AS 2.8 - Test : Part A109 & 110
 Drafting the Questionnaire 1111
 Drafting the Questionnaire 2112
 Drafting the Questionnaire 3113
 Drafting the Questionnaire 4114
 AS 2.8 - Test : Part B115
 Evaluation and Refinement 1116
 Evaluation and Refinement 2117
 AS 2.8 - Test : Part C118
 AS 2.8 - Test : Part D119
 AS 2.8 - Test : Part E120 & 121
 AS 2.8 - Test : Part F122

AS 2.9 - Statistical Inference

Internal Assessment - 4 credits

Sampling Methods 1123
 Sampling Methods 2124
 Comparing Sampling Methods125 & 126
 Evaluating Sampling Methods127
 Variability Due to Sampling Method128
 Variability Due to Sample Size129-131
 Reliable Inferences132
 An Interval Estimate for Population Median 1133
 An Interval Estimate for Population Median 2134
 Comparing Populations135
 Case Study - 'Tall Poppies'136-138
 Case Study - 'Carrying the Load'139-141
 AS 2.9 - Assessment Requirements142
 AS 2.9 - Statistical Inference - Test143

AS 2.10 - Statistical Experiments

Internal Assessment - 3 credits

Defining an Experiment144
 Posing an Investigative Question145
 Designing an Experiment146
 Planning an Experiment147
 AS 2.10 - Test : Part A148 & 149
 AS 2.10 - Test : Part B150
 Analyse, Conclude, Reflect 1151
 Analyse, Conclude, Reflect 2152
 Analyse, Conclude, Reflect 3153
 Analyse, Conclude, Reflect 4154
 Analyse, Conclude, Reflect 5155
 AS 2.10 - Test : Part C156 & 157

AS 2.11 - Evaluate a Statistical Report

Internal Assessment - 2 credits

Hand Hygiene Report158-163
 Internet Use Report164-171
 AS 2.11 - Assessment Requirements172

AS 2.12 - Probability Methods

External Assessment - 4 credits

| | |
|---|-----|
| Vocabulary and Notations | 173 |
| Absolute Risk and Relative Risk 1 | 174 |
| Absolute Risk and Relative Risk 2 | 175 |
| Absolute Risk and Relative Risk 3 | 176 |
| Introduction to Tree Diagrams | 177 |
| Using Tree Diagrams 1 | 178 |
| Using Tree Diagrams 2 | 179 |
| Using Tree Diagrams 3 | 180 |
| Mean, Standard Deviation and Proportion | 181 |
| Approximately Bell Shaped | 182 |
| The Normal Distribution 1 | 183 |
| The Normal Distribution 2 | 184 |
| The Normal Distribution 3 | 185 |
| Normal Distribution Problems 1 | 186 |
| Normal Distribution Problems 2 | 187 |
| AS 2.12 - Probability Methods - Test | 188 |

AS 2.13 - Using Simulations

Internal Assessment - 2 credits

| | |
|---|-----------|
| Selecting Tools 1 | 189 |
| Selecting Tools 2 | 190 |
| Selecting Tools 3 | 191 |
| Simulation Experiment 1 | 192 |
| Simulation Experiment 2 | 193 |
| Simulation Experiment 3 | 194 & 195 |
| Simulation Experiment 4 | 196 & 197 |
| Simulation Experiment 5 | 198 & 199 |
| Worked Example - 'Chances of a Freebie' | 200 |
| Simulation Experiment 6 | 201 |
| Simulation Experiment 7 | 202 |
| Simulation Experiment 8 | 203 |
| AS 2.13 - Using Simulations - Test..... | 204 & 205 |

AS 2.14 - Systems of Equations

Internal Assessment - 2 credits

| | |
|--|-----|
| Introduction to Systems of Equations | 206 |
| Studying Graphs 1 | 207 |
| Studying Graphs 2 | 208 |
| Using Substitution 1 | 209 |
| Using Substitution 2 | 210 |
| Using Elimination 1 | 211 |
| Using Elimination 2 | 212 |
| Comparing Methods | 213 |
| Solving Problems 1 | 214 |
| Solving Problems 2 | 215 |
| AS 2.14 - Systems of Equations - Test..... | 216 |

| | |
|-----------------------------|---------|
| Student Notes | 217-218 |
| Answers (removable) | 219-238 |
| Achievement Standards | 239-244 |

About this Book

A Choice of Standards

This mathematics workbook '*On Track 4*' prepares students to attain NCEA Level 2 Achievement Standards. The work is drawn from Levels 6 and 7 of the New Zealand Mathematics and Statistics curriculum.

The book is for students who are doing a Year 12 Applied Mathematics Course or a Year 12 Statistics Course. Work for a total of 12 Achievement Standards is included in this book (the only standards excluded are AS 2.6 - Algebra Methods and AS 2.7 - Calculus Methods). It is expected that a full-time Level 2 student will study between 5 and 7 of these standards (about 20 credits). Schools will make a selection of standards based on the ability and interests of their students.

'*On Track 4*' provides revision work for the following Achievement Standards :

| | |
|---|-----------|
| AS 2.1 - Coordinate Geometry | 2 credits |
| AS 2.2 - Graphical Methods | 4 credits |
| AS 2.3 - Sequences & Series | 2 credits |
| AS 2.4 - Trigonometry | 3 credits |
| AS 2.5 - Networks | 2 credits |
| AS 2.8 - Design a Questionnaire | 3 credits |
| AS 2.9 - Statistical Inference | 4 credits |
| AS 2.10 - Statistical Experiments | 3 credits |
| AS 2.11 - Evaluate a Statistical Report | 2 credits |
| AS 2.12 - Probability Methods | 4 credits |
| AS 2.13 - Using Simulations | 2 credits |
| AS 2.14 - Systems of Equations | 2 credits |

[black credits are internally assessed, purple credits indicate an externally assessed standard.]

It is expected that students will use a range of technology throughout the year (graphing calculator, spreadsheet). This book includes some basic instructions for the *Casio fx9750 GII* graphing calculator and a *Microsoft Excel* spreadsheet. However, these explanations are brief and more detailed information can be found in the graphing calculator's instruction booklet and in *Excel's* help menu.

I wish you well with your studies this year.

Wiesje Geldof