

Cambridge O Level  
**Mathematics**  
Vol. 1

**Audrey Simpson**



Cambridge University Press  
978-0-521-18604-9 - Cambridge O Level Mathematics: Vol. 1  
Audrey Simpson  
Frontmatter  
[More information](#)

---

CAMBRIDGE UNIVERSITY PRESS  
Cambridge, New York, Melbourne, Madrid, Cape Town,  
Singapore, São Paulo, Delhi, Tokyo, Mexico City

Cambridge University Press  
4381/4 Ansari Road, Daryaganj, New Delhi 110002, India

[www.cambridge.org](http://www.cambridge.org)  
Information on this title: [www.cambridge.org/9780521186049](http://www.cambridge.org/9780521186049)

© Cambridge University Press 2012

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First Published 2012

Printed in India at

*A catalogue for this publication is available from the British Library*

ISBN 978-0-521-18604-9 Paperback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Every effort has been made to trace the owners of copyright material included in this book. The publishers would be grateful for any omissions brought to their notice for acknowledgement in future editions of the book.

# Contents

Introduction	vii
Acknowledgements	viii
Note	ix
<b>1 Understanding Number</b>	<b>1</b>
Essential Skills	1
Sets of Numbers	2
Prime Numbers, Factors and Multiples	5
Highest Common Factor (HCF) and Lowest Common Multiple (LCM)	8
Tests of Divisibility without using a Calculator	8
Operations and Inverses	10
Squares and Square Roots, Cubes and Cube Roots	10
Directed Numbers	13
Important Mathematical Symbols	15
Ordering Integers	16
Standard Form	16
Order of Working in Calculations	17
<b>2 Fractions, Decimals and Percentages</b>	<b>22</b>
Essential Skills	22
Understanding Common Fractions	23
Working with Common Fractions	26
Percentages	35
Conversion between Common Fractions, Decimals and Percentages	36
Ordering Quantities	40
<b>3 Beginning Algebra</b>	<b>45</b>
Essential Skills	45
Using Letters and Numbers	46
The Language of Algebra	49
Addition and Subtraction of Terms in Algebra	53
Multiplication and Division in Algebra	54
Working with Directed Numbers	55
Working with Indices	60
Brackets and Common Factors	65

iv *Contents*

<b>4</b>	<b>Working with Numbers</b>	<b>72</b>
	Essential Skills	72
	More Symbols	73
	Units of Measurement	73
	Estimation	77
	Approximation	79
	Limits of Accuracy	83
	Changing Units	85
	Working without a Calculator	87
	Working with a Calculator	91
	Proportion	99
	Time	101
	Rate	104
	Compound Units	106
	Personal and Household Finance	108
<b>5</b>	<b>Working with Algebra</b>	<b>120</b>
	Essential Skills	120
	Solution of Equations	121
	Rearranging Formulae	127
	Sequences	132
	Simultaneous Equations	136
<b>6</b>	<b>Geometry and Shape</b>	<b>147</b>
	Essential Skills	148
	Lines and Angles	149
	Pairs of Lines	153
	Investigation	155
	Triangles	156
	Practical Work	157
	Methods for Constructing Triangles Accurately	157
	Angles in Parallel Lines	162
	Symmetry	164
	Quadrilaterals	168
	Polygons	172
	Circles	176
	Practical Work	177
	Solid Shapes	179
	Nets	181
	Similar and Congruent Shapes	183
	Scale Drawings	185

<b>7</b>	<b>Algebra and Graphs</b>	<b>210</b>
	Essential Skills	210
	Axes, Coordinates, Points and Lines	211
	Everyday Graphs	217
	Graphs with Algebra	222
	Drawing Curves	239
<b>8</b>	<b>Length, Area and Volume</b>	<b>255</b>
	Essential Skills	255
	Length	256
	Practical Investigation	258
	Area	264
	Volume	277
<b>9</b>	<b>Trigonometry</b>	<b>290</b>
	Essential Skills	290
	The Tangent Ratio	291
	The Sine and Cosine Ratios	301
	Pythagoras' Theorem	304
	Bearings	312
	Angles of Elevation and Depression	319
<b>10</b>	<b>Transformations and Vectors</b>	<b>329</b>
	Essential Skills	329
	Transformations	330
	Reflection	330
	Translations and Vectors	339
	Rotation	347
	Enlargement	353
	More about Vectors	359
	Recognising Transformations	363
<b>11</b>	<b>Statistics</b>	<b>375</b>
	Essential Skills	376
	Collecting and Organising Data	377
	Examples of Surveys	377
	Types of Data	380
	Illustrating the Data	380
	Frequency Polygons	388
	Pie Charts	391
	Mean, Median, Mode and Range	397
	The Mean, Median and Mode from a Frequency Table	401
	Statistics in the Media	404

vi *Contents*

<b>12 An Introduction to Probability</b>	<b>417</b>
Essential Skills	417
Some Terms Used in the Study of Probability	418
Theoretical (or Calculated) Probability	420
Experimental Probability or Relative Frequency	424
Combined Events	426
<b>Revision and Examination Technique</b>	<b>436</b>
<b>Answer key</b>	<b>439</b>
<b>Index</b>	<b>501</b>

## Introduction

This book covers the first year of a two-year course leading to the Cambridge O Level Mathematics examination from University of Cambridge International Examinations. Topics are introduced in O Level Vol. 1 and developed in O Level Vol. 2. The entire course is covered by the two volumes.

Students will find that the structure of the book enables them to proceed at their own pace by reading the explanatory text, following the worked examples and then working through the exercises with frequent checking of their answers at the back of the book. They are encouraged to give sufficient working in their answers to show that they understand the methods required to obtain the correct answer.

At the end of each chapter appropriate examination questions give the students the chance to practise answering the types of questions which will be found in their examinations. This consolidates their work in each chapter before they move on to the next. These questions also sometimes refer back to earlier topics to help keep those fresh in their minds. Examination questions are from both the O Level past papers, and where appropriate, from IGCSE past papers.

The Cambridge O Level examination consists of two papers. Calculators are not allowed to be used in Paper One; but they may be used in Paper Two. O Level Vol.1 provides plenty of practise in, and methods for, working without a calculator, as well as guidance in the efficient use of calculators. Students are encouraged to work without a calculator where possible.

A final section gives suggestions for establishing a good revision programme, and hints to enable students to obtain the best possible marks in their end of year examinations.

### Note to students

Your examination will consist of two papers, one of which will be a non-calculator paper. You should follow the instructions in this book regarding the use of calculators. Where the instruction indicates that you should not use a calculator it really is essential that you put your calculator to one side. Failing to practise working without a calculator will lead to difficulty when you are sitting for Paper One!

## Acknowledgements

I would like to thank Professor Gordon Kirby for his invaluable advice and encouragement. I am also grateful for his efforts to check my work patiently for errors, both mathematical and stylistic.

I am also indebted to my sister, Pat Victor, for the times she sorted out frustrating problems with both my computer and the software needed for the production of the manuscript.

Audrey Simpson



## Note

A note about the currencies used in this book:

1 dollar (\$) is worth 100 cents.

1 rupee [Re (singular) or Rs (plural)] is worth 100 paise (singular paisa).

1 pound (£) is worth 100 pence.

1 euro (€) is worth 100 cents.

Unless greater accuracy is required, answers to money questions which are not whole numbers, should be given to 2 decimal places.

For example, \$12.7 would be given as \$12.70, which is read ‘twelve dollars and seventy cents’.