

UNDERSTANDING MAPLE

Maple is a powerful symbolic computation system that is widely used in universities around the world. This short introduction gives readers an insight into the rules that control how the system works, and how to understand, fix, and avoid common problems.

Topics covered include algebra, calculus, linear algebra, graphics, programming, and procedures. Each chapter contains numerous illustrative examples, using mathematics that does not extend beyond first-year undergraduate material. Maple worksheets containing these examples are available for download from the author's website. The book is suitable for new users, but where advanced topics are central to understanding Maple they are tackled head-on. Many concepts which are usually absent from introductory books and manuals are described in detail.

With this book, students, teachers, and researchers will gain a solid understanding of Maple and how to use it to solve complex mathematical problems in a simple and efficient way.

UNDERSTANDING MAPLE

IAN THOMPSON

University of Liverpool



CAMBRIDGE
UNIVERSITY PRESS

Cambridge University Press & Assessment
978-1-316-62814-0 — Understanding Maple
Ian Thompson
Frontmatter
[More Information](#)

CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314-321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi - 110025, India

103 Penang Road, #05-06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781316628140
10.1017/9781316809761

© Ian Thompson 2017

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 2017

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

ISBN 978-1-316-62814-0 Paperback

Additional resources for this publication at www.cambridge.org/maple

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.

Contents

Acknowledgements	<i>page viii</i>
1 Introduction	1
1.1 Why This Book?	2
1.2 The Maple Interface	3
1.3 How to Read This Book	4
2 Getting Started	6
2.1 Configuring the Interface	6
2.2 The Help System	9
2.3 Statements and Execution	10
2.4 Spaces, Line Breaks and Comments	16
2.5 Execution Groups	18
2.6 Sections	19
2.7 Displayed Results and Return Values	19
2.8 Obtaining Approximate Results	21
2.9 Elementary Functions	24
2.10 Complex Numbers	27
2.11 Variables	31
2.12 Names	34
2.13 Automatic Simplification and Evaluation	37
2.14 Concatenation	42
2.15 Relational Operators	44
2.16 Sequences	48
2.17 Sets and Lists	49
2.18 Indices	53
2.19 Element-wise Operations	56
2.20 The seq, add and mul Commands	58
2.21 Types	62

	2.22 Packages	65
3	Algebra and Calculus	71
	3.1 Manipulating Expressions	71
	3.2 Extracting Parts of an Expression	76
	3.3 Substitutions	79
	3.4 Functions	81
	3.5 Limits	87
	3.6 Summing Series	89
	3.7 Differentiation	92
	3.8 Integration	94
	3.9 Series Expansions	97
	3.10 Assumptions	99
4	Solving Equations	103
	4.1 Solving Single Equations	103
	4.2 Solving Multiple Equations	107
	4.3 Solving Approximately	109
	4.4 Differential Equations	113
5	Linear Algebra	117
	5.1 Creating Matrices and Vectors	117
	5.2 Accessing Vector and Matrix Entries	120
	5.3 Displaying Matrices and Vectors	122
	5.4 Addition, Multiplication and Scalar Products	123
	5.5 Vector Products and Norms	125
	5.6 Other Matrix Operations	127
	5.7 Solving Linear Systems	129
	5.8 Copying Matrices and Vectors and Testing for Equality	129
6	Graphics	133
	6.1 Creating Basic Plots	133
	6.2 Customising a Plot	135
	6.3 Parametric and Polar Plots	137
	6.4 Three-Dimensional Plots	138
	6.5 Combining Plots	140
	6.6 Plots from Data	141

Contents vii

6.7	Animations	144
7	Programming	147
7.1	Conditional Statements	147
7.2	Do Loops	150
7.3	Nesting and printlevel	158
7.4	The print and printf Commands	159
7.5	Arrays	162
7.6	Tables	168
8	Procedures	174
8.1	A Basic Procedure	174
8.2	The Structure of a Procedure	176
8.3	Local and Global Variables	178
8.4	Arguments and Parameters	183
8.5	Checking Argument Validity	189
8.6	Data Returned by Procedures	191
8.7	Returning Unevaluated	192
8.8	Output Displayed from Within Procedures	195
8.9	Remember Tables and Recursion	195
8.10	Viewing a Procedure Definition	197
9	Example Programs	200
9.1	Pascal’s Triangle	200
9.2	The Collatz Problem	203
9.3	A Newton–Raphson Iteration	205
9.4	Sorting Data	208
9.5	Quadrature Formulae	211
9.6	Necklaces	215
<i>Appendix A</i>	Other Ways to Run Maple	219
<i>Appendix B</i>	Terminating Characters	223
	<i>Index of Maple Notation</i>	225

Acknowledgements

The author gratefully acknowledges the assistance of Dr Martyn Hughes, for his careful reading of several drafts, and also the reviewers appointed by Cambridge University Press and the development team at Maplesoft, for their many constructive suggestions. Thanks must also go to Maplesoft's technical support staff, for answering numerous questions of varying quality. However, the most substantial acknowledgement is due to the students and colleagues who have brought their difficulties with Maple to the author's attention. Many of the examples in this book were motivated by their problems.