

Contents

List of Figures	viii
Preface	ix
1 Introduction	1
1.1 What we cover in this book	2
1.2 Overview of the CALM Project	3
1.2.1 Software structure	3
1.2.2 Pascal vs an authoring language	4
1.2.3 Hardware	5
1.2.4 The CALM Project team	6
1.2.5 Evaluating the end product	7
1.3 Building a CALM unit	7
2 CAL in General	11
2.1 Display	13
2.1.1 Placing text on the screen	13
2.1.2 Clearing space on the screen	16
2.2 Control	16
2.2.1 Program control of display rate	17
2.2.2 Student control of display rate	17
2.2.3 Choosing a route through the unit	19
2.3 Input	28
2.3.1 Reading a single key from the keyboard	28
2.3.2 Clearing the keyboard buffer	29
2.3.3 A general string input routine	29
2.4 Messages and queries	35
2.4.1 Getting a yes/no answer	39
2.5 Pop-up menu and help	41
2.6 Graphics and animation	50

2.7	Use of student files	50
2.8	Summary	51
3	CAL in Mathematics	53
3.1	Mathematical display	54
3.1.1	Common mathematical formats	55
3.1.2	Special symbols	57
3.2	Mathematical input	59
3.2.1	Using the function keys to input mathematical symbols	59
3.2.2	Entering an algebraic expression	60
3.3	Evaluating an expression	61
3.4	Checking answers	76
3.4.1	Constant functions	78
3.4.2	Functions of one variable	79
3.4.3	Functions of two or more variables	83
3.4.4	Using <i>Compare</i>	84
3.5	Using randoms	90
3.6	IBM compatibility	92
3.7	Summary	93
4	Test Section	95
4.1	The student's view	96
4.1.1	A test example	97
4.1.2	Escape route and on-line help	101
4.2	The teacher's view	102
4.3	The programmer's view	105
4.3.1	Test data structure	106
4.3.2	Test program outline	109
4.4	Lessons learnt	112
4.4.1	Motivation	112
4.4.2	Encouraging good mathematical practice	113
4.4.3	Discouraging cheating	114
4.4.4	Are the "true" answers correct?	114
4.4.5	The future	115
4.5	Summary	115
5	Graphics Routines for Mathematics	117
5.1	Setting up the graphics routines	117
5.2	Drawing a curve	123
5.3	Parametric curves	124
5.4	Simple diagrams	126
5.5	Instructive animations	128

5.6	Summary	133
6	Mathematical Games	135
6.1	The Sky's the Limit	135
6.2	Mathematical models	145
6.3	Fireman	147
6.4	Further ideas	161
6.5	Summary	163
7	Conclusions	165
7.1	Educational evaluation of CALM	165
7.2	Some summative evaluation of CALM	166
7.3	Some CALM reflections	168
7.4	Some disadvantages of CAL	169
7.5	The future for CALM	170

Appendices

A	Elements of Pascal	173
B	Some Aspects of MS-DOS	185
B.1	Directories and file management	186
B.2	System set-up and the use of batch files	187
C	Graphics Support Library	191
C.1	Initialising the graphics	193
C.2	Line drawing	194
C.3	Plotting markers	196
C.4	Filling areas	196
C.5	Plotting text	198
C.6	Copying and saving areas of the screen	198
C.7	Use of sprites	199
D	Index of Routines	201
	Index	203