

# **essential maths**

**on the bbc and electron computers**

basic routines for programming

**czes kosniowski**

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# Contents in detail

## CHAPTER 1

### Simple functions

Displaying numbers neatly, rounding off numbers, bank balances, overdrawn bank balances, colourful balances.

## CHAPTER 2

### Trigonometry

Scale drawings, the trigonometry functions, inverse functions, non right-angled triangles, refraction, reflection.

## CHAPTER 3

### Earth Trigonometry

The Earth, lines of longitude and latitude, calculating distances.

## CHAPTER 4

### Powers

Square roots, imaginary numbers, quadratic equations, solving other equations, Newton's method, exponential functions, logarithmic functions, roots of other functions.

## CHAPTER 5

### Sequences

Arithmetic sequences, geometric sequences, calculating interest, double or quit, Fibonacci sequences.

## CHAPTER 6

### Number Bases

Decimal representation, coefficients, binary numbers, hexadecimals, base converter, Acorn numbers, small numbers, floating points.

## CHAPTER 7

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## Days and Weeks

Calculating dates —Zeller' s formula, calendar, date management.

## CHAPTER 8

### Greatest Common Divisor

Common factors, greatest common divisor, the Euclidean algorithm.

## CHAPTER 9

### Primes

Prime and composite numbers, testing primes, Sieve of Eratosthenes, large primes, Mersenne numbers, probabilistic primality testing, pseudoprimes.

## CHAPTER 10

### Odds and Ends

Pythagorean triplets and multi-precision powers.

## CHAPTER 11

### Matrices

Introducing matrices, adding matrices and how it can help, matrix multiplication, and why, zero matrices, identity matrices, inverses of matrices, simultaneous equations.

## CHAPTER 12

### Codes

Substitution codes, matrix codes, public key codes, encoding and decoding messages.

## CHAPTER 13

### Random!

Heads and tails, of dice and men, playing cards, non-equally likely events.

## CHAPTER 14

### Meaningful Data

Handling large amounts of numerical data, the mean, max, min and spread, standard deviation and variance, confidence intervals.

## Preface

This book is written for owners of a BBC microcomputer or an Electron, who would like to know that little bit more about some mathematical techniques. You probably know what program you want to write but maybe you are not quite sure of the mathematics needed. Is it COS, ABS, or SGN that you need?

All the mathematical functions that you find on the BBC/Electron are described and their use is illustrated in short programs. You can lift these programs and utilize them within your own programs.

But this book is not just an introduction to these basic mathematical functions. It contains background information and programs on such diverse subjects as codes and cryptography, random numbers, sequences, trigonometry, prime numbers, and statistical data analysis. You can utilize this information in both serious and games programming.

Many thanks to Ann, Kora and Inga for bearing with me during the writing of this book.

*Czes Kosniowski  
Newcastle upon Tyne, January 1984*

## **Program notes**

The programs have been written in MODEs 0 to 6, to make them accessible to both the BBC and Electron microcomputers. Some minor changes to the programs may be necessary if you have a BBC micro with an old operating system. Lines involving an INPUT statement with a semicolon may need the semicolon to be changed to a comma. For instance, the line

```
100 INPUT "What is your name ";N$
```

may need to be changed to the following

```
100 INPUT "What is your name ",N$
```

Note: The symbol ^ sometimes appears as ↑ in certain MODEs.

When entering programs from the listings in this book, please ensure that they are keyed in correctly. The quality of the hardcopy from the printer may make some characters look similar — in particular, a comma may look very like a full stop at first glance.