

## **Summary**

(By Chapter)

### **1. Simple functions**

Displaying numbers neatly  
Right-justified numbers  
INT, the integral part of a number  
ABS, the absolute value of a number  
Rounding off numbers  
Rounding up and down  
Rounding off a number to D decimal places  
Bank balances  
Overdrawn bank balances  
SGN, the sign or signum function  
Displaying bank balances colourfully

### **2. Trigonometry**

Scale drawings  
Estimating heights and distances  
Right-angled triangles  
Trigonometric functions, TAN, SIN and COS  
Hypotenuse, opposite side, adjacent side  
Radian  
PI  
Degrees to radians, radians to degrees  
Finding lengths of a right-angled triangle  
Inverse functions  
Arc tangent, ATN  
Arc sine, ASN  
Arc cosine, ACS  
Pythagoras' theorem  
Non right-angled triangles  
Law of cosines  
Law of sines  
Finding angles and/or sides of a triangle  
Refraction  
Angle of incidence, angle of refraction  
Snell's law  
Refractive index  
Reflection  
Critical angle

### **3. Earth trigonometry**

The Earth

Straight lines on the Earth

Great circles

Lines of longitude

Greenwich, England

Lines of latitude

Calculating the distance between two points on the Earth

### **4. Powers**

Squares of numbers

Powers of numbers

Properties of powers

SQR, square root

Imaginary numbers

Complex numbers

Complex numbers on the BBC and Electron micros

Quadratic equations

Solving quadratic equations

Roots, finding roots

Formula for the roots of a quadratic equation

Discriminant

Solving quadratic equations on your computer

Solving other equations

Polynomial equation

Degree of a polynomial

Roots of polynomials

Newton' s method

Derivative of a polynomial

Finding roots via Newton' s method

EXP, the exponential function

E, EXP(1)

Factorial

Properties of the exponential function

Formula for exponential function

Logarithmic function

LN, the natural logarithmic function

Properties of the logarithmic function

Finding roots of other functions

### **5. Sequences**

Sequences

Terms of a sequence

Generating sequences

Arithmetic sequence, arithmetic progression  
Common difference  
Generating arithmetic sequences  
Which would you prefer?  
Geometric sequence, geometric progression  
Common ratio  
Generating geometric sequences  
Interest, compound interest  
Daily interest  
Double or quit gambling  
Fibonacci sequences  
Generating Fibonacci sequences

### **6. Number bases**

Decimal system  
Digits  
Decimal representation  
Base  
Coefficients of a number  $N$  to a base  $B$   
Binary number system  
Hexadecimal numbers  
Converting numbers from one base to another  
Numbers on computers  
PEEKing at numbers  
Binary form of numbers between 0 and 1  
Displaying binary form of numbers between 0 and 1  
Floating points  
Binary exponent  
Binary mantissa

### **7. Days and weeks**

Days of the week  
Zeller' s congruence  
Finding the day of the week for any given date  
Displaying a monthly calendar for any month, any year  
Date management  
Pseudo-Julian date  
Listing dates a specified number of days apart

### **8. Greatest common divisor**

Common divisor, common factor  
Greatest common divisor, highest common factor  
Euclidean algorithm  
Calculating the greatest common divisor

Least common multiple

Calculating the least common multiple

### **9. Primes**

Prime number

Composite number

There are infinitely many prime numbers

Sieve of Eratosthenes

Prime testing

Finding factors

Large primes

Mersenne numbers, Mersenne primes

Largest known prime

Probabilistic primality testing

Fermat' s little theorem

Pseudoprime to a base

Most pseudoprimes are genuine primes

### **10. Odds and ends**

Pythagorean triplets

Primitive Pythagorean triplets

Multi-precision powers

Calculating products of large numbers accurately on your computer

Calculating arbitrary large powers accurately

### **11. Matrices**

Matrices, rectangular arrays of numbers

M by N matrix

Square matrix

Adding matrices

Why add matrices

Matrix multiplication

Why multiply matrices?

Zero matrix

Identity matrix

Inverse of a matrix, reciprocal of a matrix

Calculating the inverse of a matrix

Simultaneous matrices

Solving simultaneous matrices

### **12. Codes**

Cryptography

Ciphers

Substitution codes

Sample substitution code program  
Matrix codes  
Using matrices to cipher messages  
Sample matrix code program  
Public-key codes  
Prime numbers and secure codes

**13. Random!**

Heads and tails  
Tossing coins  
Random numbers  
Simulating coin spinning on a computer  
Of dice and men  
Die rolling  
Probability  
Simulating die rolling  
Simulating two dice rolling  
Playing cards  
Simulating card picking  
Shuffling a pack of cards randomly  
Non-equally likely events  
Bucket with 100 coloured buttons  
Simulating button picking from a bucket

**14. Meaningful data**

Entering numerical data into a computer  
Mean, average  
Calculating the mean  
Maximum and minimum  
Spread, range  
Calculating the max, min and spread  
Standard deviation  
Variance  
Calculating the standard deviation  
Confidence intervals  
Normal distribution  
Calculating confidence intervals for a population  
Calculating confidence intervals for the mean  
Student' s t distribution



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