

# CONTENTS

<b>I. Indices, logarithms and 'surds</b>	<b>PAGE</b>
The index laws	I
Logarithmic form of the index laws	
Change of base	2
Surds	3
Equations involving surds	3
<b>II. Variation</b>	
Direct proportion	8
The linear law	9
Inverse proportion	10
Variation as the square	11
The inverse square law	12
y proportional to any power of x	13
Joint variation	14
<b>III. The Theory of quadratic equations</b>	
Real, equal and imaginary roots	18
Sum and product of the roots	18
Symmetrical functions of the roots	18
Forming equations	19
Maximum and minimum values of quadratic expressions	19
Maximum and minimum values of certain fractions	19
<b>IV. Factors and some developments</b>	
Test for factors	23
Remainder theorem	23
Cubic equations	23
Factors of $a^3 + b^3$ and $a^3 - b^3$	23
Symmetry	24
Cyclic symmetry	24
$\Sigma$ notation	24
Equating of coefficients	24
Partial fractions	25

	PAGE
<b>V. Permutations and combinations</b>	
Terminology	29
Notation	29
Evaluation of ${}_n P_r$	29
Permutations with repetitions	30
Permutations of $n$ things, $n$ at a time	30
Evaluation of ${}_n C_r$	30
Special cases of ${}_n C_r$	30
To divide $n$ things into groups of $p, q, r, \dots$	31
Total number of combinations of $n$ things	31
<b>VI. The binomial theorem (for a positive integral index)</b>	
Pascal's triangle	37
The binomial theorem for a positive integral index	38
Special cases	38
Sum of the coefficients	38
Expansion of $(1-x)^n$	38
Expansion of $(a+x)^n$	39
Ratio of successive terms	39
<b>VII. Probability</b>	
Introduction	41
Assumptions	42
Definition	42
Addition of probabilities	43
Multiplication of probabilities	44
Representation of probabilities by algebraic expansions	44
Binomial probability-distributions	45
<b>VIII. Finite series</b>	
Arithmetic and geometric progressions	50
Sum of an arithmetic progression	51
Sum of a geometric progression	51
The method of differences	52
First differences and summation of some standard series	52
Methods of application	54
Arithmetic and geometric means	54
Inequality theorem	55

<b>IX. Infinite series</b>	<b>PAGE</b>
Introduction	59
Infinite geometric series	60
"Sum to infinity" of a geometric series	60
Divergent geometric series	61
Definition of convergence	61
Divergence of $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$	61
D'Alembert's test for convergence	61
Series of alternately positive and negative terms	62
Binomial series	62
Special cases	63
Expansion of $(a+x)^n$	63
Approximations	64
Error in approximations	64
The exponential series	64
Greatest term, etc.	65
Logarithmic series	65
Other series	66
<b>X. Statistics</b>	
Introduction	73
Statistics	73
Frequency distributions	74
Normal curve of errors	75
Mode	75
Median and quartiles	76
Mean and standard deviation	76
Coefficient of variation	79
Probable error	80
Standard errors of mean and standard deviation	80
Linear regression	80
Correlation	83
<b>Answers</b>	<b>95</b>
Index	<b>101</b>