

**A GUIDE TO THE MATHEMATICAL  
STUDENT IN READING,  
REVIEWING, AND WORKING  
EXAMPLES; PART I, PURE  
MATHEMATICS**

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A Guide to the Mathematical Student in Reading, Reviewing, and Working Examples; Part I,  
Pure mathematics by Charles Lutwidge Dodgson

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**CHARLES LUTWIDGE DODGSON**

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PURE MATHEMATICS**



## PREFACE.

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THE object of the following pages is twofold :—

First, to exhibit, in a compendious form, the whole subject-matter of Pure Mathematics, arranged in the order in which it would usually be advisable that the student should go through it. This Syllabus may be useful as an aid in laying out plans of reading and reviewing, and in shewing the student at a glance where he is on his course, how much is done, and how much remains to be done.

Secondly, to furnish a guide for working examples in the whole subject, so arranged as to secure that the most important subjects shall have the largest share of attention. The Cycle intended for this purpose consists of two columns: one containing the numbers from 1 to 1702, the other, references to the Syllabus. It is intended that the student using it should turn to the Syllabus for each reference, and work two or three examples in the subject there indicated, (of course passing over all references to subjects he has not read,) and at the end of each day's work mark what point in the Cycle he has reached.

## PREFACE.

In the Syllabus, the small figures to the left of the line indicate how often each subject is referred to in the Cycle: so that if the teacher should consider that the examples assigned to any subject are either too many or too few, he can remedy the defect by erasing references in the Cycle, or by inserting additional ones.

The present attempt is, no doubt, deficient and faulty in many respects: and any suggestions from Mathematical teachers for remedying its defects will be gratefully received by the compiler.

*Christ Church, Oxford,  
December, 1864.*



## GENERAL LIST OF SUBJECTS.

- 
- |     |  |
|-----|--|
| 30  | A. Arithmetic.   |
| 20  | B. Euclid I, II.   |
| 75  | C. Algebra; to Quadratic Equations.                        |
| 23  | D. Euclid III, IV.   |
| 45  | E. Algebra; from Quadratic Equations to Binomial Theorem.* |
| 16  | F. Euclid V, VI.   |
| 114 | G. Linear Algebraical Geometry.                            |
|     | Plane do. to end of Trigonometry                           |
|     | (1st time).  |
| 45  | H. Geometrical Conic Sections.                             |
| 100 | I. Algebra; from Binomial Theorem to Theory of Equations.  |
| 45  | J. Higher Plane Pure Geometry.                             |
| 110 | K. Plane Algebraical Geometry; from end of Trigonometry    |
|     | to Quadratic Loci (constructed from Geometrical            |
|     | properties).   |
| 24  | L. Plane Algebraical Geometry; Trigonometry (2nd time).    |
| 120 | M. Plane Algebraical Geometry; Quadratic Loci (constructed |
|     | from Equations).   |
| 135 | N. Differential Calculus (1st time).                       |
| 19  | O. Calculus of Finite Differences (1st time).              |
| 20  | P. Euclid XI, XII, and higher Solid Pure Geometry.         |
| 22  | Q. Solid Algebraical Geometry; to end of Stereometry.      |
| 65  | R. Solid Algebraical Geometry; from end of Stereometry     |
|     | to Quadratic Superficial Loci (constructed from            |
|     | Geometrical properties).                                   |
| 37  | S. Higher Plane Algebraical Geometry.                      |
| 135 | T. Integral Calculus (1st time).                           |
| 45  | U. Solid Algebraical Geometry; Quadratic Superficial Loci  |
|     | (constructed from Equations).                              |
| 77  | V. Higher Algebra.   |
| 145 | W. Differential Calculus (2nd time).                       |
| 102 | X. Integral Calculus (2nd time).                           |
| 25  | Y. Calculus of Finite Differences (2nd time).              |
| 35  | Z. Calculus of Variations.                                 |

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\* i. e. From Quadratic Equations *exclusive* to Binomial Theorem *inclusive*. The same rule of interpretation applies to J, K, &c.

## SUBJECTS SUBDIVIDED.

### A.

#### Arithmetic.

- 1 1. Addition, Subtraction, Multiplication, and Division ; (Simple.)
- 2 2. Greatest Common Measure and Least Common Multiple.
- 3 3. Square root and Cube root.
- 3 4. Vulgar Fractions ; addition, subtraction, multiplication, and division.
- 3 5. Decimal Fractions ; addition, subtraction, multiplication, and division.
- 2 6. Circulating Decimals.
- 1 7. Reduction from one denomination to another.
- 1 8. Addition, Subtraction, &c. (Compound).
- 3 9. Reduction of Fractions (vulgar and decimal) of higher denomination to lower ; and of lower denomination to fractions (vulgar and decimal) of higher.
- 1 10. Practice.
- 2 11. Mensuration, Superficial and Solid.
- 1 12. Duodecimals.
- 2 13. Rule of Three ; Direct, Inverse, and Double. Proportional parts.
- 3 14. Interest, Simple and Compound. Discount. Equation of payments. Stocks.
- 4 15. Miscellaneous, viz. : Exchange. Profit and Loss. Partnership, &c.

### B.

#### Euclid I, II.

1. Book I.
2. Book II.
- 6 3. Deductions from Book I. Problems.
- 7 4. do. do. Theorems.
- 3 5. Book II. Problems.
- 4 6. do. do. Theorems.



## C.

## Algebra; to Quadratic Equations.

- 
- |    |     |  |
|----|-----|--|
| 2  | 1.  | Addition, Subtraction, Multiplication, and Division. |
| 2  | 2.  | Greatest Common Measure and Least Common Multiple.   |
| 5  | 3.  | Fractions.   |
| 3  | 4.  | Involution and Evolution.                            |
| 4  | 5.  | Fractional Indices.                                  |
| 9  | 6.  | Equations, one unknown quantity; Simple.             |
| 10 | 7.  | do. do. Quadratic.                                   |
| 6  | 8.  | do. two or more unknown quantities; Simple.          |
| 6  | 9.  | do. do. Quadratic.                                   |
|    |     | Problems leading to Equations,                       |
| 5  | 10. | One unknown quantity; Simple.                        |
| 6  | 11. | do. Quadratic.                                       |
| 5  | 12. | Two or more unknown quantities; Simple.              |
| 6  | 13. | do. Quadratic.                                       |
| 2  | 14. | Theory of Equations (1st time).                      |
| 4  | 15. | Miscellaneous.                                       |
- 

## D.

## Euclid III, IV.

- 
- |   |    |                                     |
|---|----|-------------------------------------|
|   | 1. | Book III.                           |
|   | 2. | Book IV.                            |
| 6 | 3. | Deductions from Book III. Problems. |
| 8 | 4. | do. do. Theorems.                   |
| 4 | 5. | do. Book IV. Problems.              |
| 5 | 6. | do. do. Theorems.                   |
- 

## E.

Algebra; from Quadratic Equations  
to Binomial Theorem.

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- |   |    |                                   |
|---|----|-----------------------------------|
| 2 | 1. | Inequalities.                     |
| 6 | 2. | Ratio, Proportion, and Variation. |

- 9 3. Series ; Arithmetical, Geometrical, and Harmonical.  
 9 4. Permutations and Combinations.  
 5 5. Binomial Theorem.  
 6 6. Logarithms, use of.  
 4 7. Chances (1st time).  
 4 8. Miscellaneous.
- 

## F.

## Euclid V, VI.

1. Book V.  
 2. Book VI.  
 8 3. Deductions from Book VI. Problems.  
 8 4. do. do. Theorems.
- 

## G.

## Linear Algebraical Geometry.

Plane do. to  
 end of Trigonometry (1st time).

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## Linear Algebraical Geometry.

- 5 1. Representation and discussion of lengths absolute.  
 2. do. do. do. with direction.  
 3. do. of positions of Points by means of  
 lengths ; and discussion of such lengths.  
 3 4. Interpretation of Equations ; and discussion of Points.
- 

## Plane Algebraical Geometry.

- 5 5. Representation and discussion of magnitudes absolute.  
 6. do. do. do. with direction.  
 7. Goniometry : i. e., representation of angles, with direction, by  
 means of ratios ; and discussion of such ratios.  
 12 8. Angles ; relations between goniometrical ratios of an angle.  
 6 9. do. goniometrical ratios of particular angles.  
 18 10. do. relations between goniometrical ratios of two or more  
 angles.

- 7 11. Angles ; inverse function.  
 5 12. do. elimination of goniometrical ratios.  
 13. Theory of Projection (Plane).  
 18 14. Trigonometry ; properties of Triangles.  
 6 15. do. do. Quadrilateral Figures inscribed in  
 Circles.  
 5 16. do. do. regular Polygons.  
 16 17. Heights and distances.  
 8 18. Miscellaneous, viz., Subsidiary angles, &c.

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## H.

### Geometrical Conic Sections.

1. Ellipse.  
 2. Hyperbola.  
 3. Parabola.  
 4 4. Problems on Parabola.  
 5 5. Theorems do.  
 5 6. Problems on Ellipse.  
 8 7. Theorems do.  
 5 8. Problems on Hyperbola.  
 8 9. Theorems do.  
 5 10. Miscellaneous, viz., mechanical methods of tracing curves, &c.

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## I.

### Algebra ; from Binomial Theorem to Theory of Equations.

- 6 1. Evolution of Binomial Surds.  
 12 2. Indeterminate Coefficients.  
 6 3. Continued Fractions.  
 10 4. Indeterminate Equations, (1st and 2nd degree).  
 7 5. Partial Fractions.  
 3 6. Scales of Notation.