THE ELEMENTS OF ALGEBRA; DESIGNED FOR THE USE OF SCHOOLS. PART I

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THE USE OF SCHOOLS.

BY THE

REV. J. W. COLENSO, D.D.,
BISHOP OF NATAL.

PART I.

FROM THE THIRTEENTH LONDON EDITION.

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ADVERTISEMENT.

In this Edition (which is *stereotyped*, and so will be secured from further change) the Simpler Parts, those, namely, suited for general School purposes and required for the attainment of an ordinary B.A. degree in the University of Cambridge, are printed separately as Part I; to which is appended a large collection of easy Miscellaneous Examples, specially adapted to the contents of this Part, and supplying means of complete Examination in them.

It will be seen that the easiest kinds of Simple Equations and Equation Problems are in this Edition introduced much earlier than is usual in Treatises on Algebra: but there can be no reason why this branch of the subject, which is so interesting to most Students, and gives them some idea of the practical applications of the Science, should not be brought forward as soon as possible.

Part II is also published, and contains the higher parts of the Subject, with such additional remarks on

the earlier portions as will suit the wants of more advanced and promising Students, and with a similar Appendix of more difficult Miscellaneous Examples and Equation Papers. This Part may be begun as soon as the Student, having thoroughly mastered Part I, has entered upon the Miscellaneous Examples at the end of it.

Fornsett St. Mary, Nov. 1, 1849.

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ALGEBRA.

PART I.

CHAPTER I.

DEFINITIONS.

1. ALGEBRA is the science which reasons about quantities by means of letters of the Alphabet, and certain signs and symbols, which are employed to represent both the quantities themselves, and the manner in which they are connected with others.

Thus we might put a to represent 7, and then *twice* a would represent 14; or we might put a to represent 3, and then *twice* a would represent 6, *three times* a, 9, &c.

2. The sign $=$ (*equal*) denotes that the quantities between which it stands are equal to one another.

Thus, if $a = 17$, then *twice* $a = 34$.

3. The sign $\therefore$ stands for *then* or *therefore*, and $\because$ for *since* or *because*.

4. The sign $+$ (*plus*) denotes that the quantity before which it stands is *added*, and the sign $-$ (*minus*) that the quantity before which it stands is *subtracted*.

Thus $5 + 3 = 8$, $5 - 3 = 2$; and if $a = 3$ and $b = 4$,
then $a + b = 3 + 4 = 7$, $a + b + 2 = 3 + 4 + 2 = 9$,
$10 - a = 10 - 3 = 7$, $10 - a - b = 10 - 3 - 4 = 7 - 4 = 3$.

The sign $\sim$ is used to denote that the less of two quantities is taken from the greater, when it is not known which *is* the greater.

Thus $a \sim b$ denotes the *difference* between a and b.

5. All quantities before which + stands are called *positive*, and all before which − stands are called *negative* quantities.

If neither + nor − stand before a quantity, + is understood, and the quantity is positive; thus a means $+a$.

6. The sign × (*into*) denotes that the quantities between which it stands are to be multiplied together; but very often a full-point is used instead of ×, or, still more commonly, one quantity is placed close after the other without any sign between them.

Thus $a \times b$, $a.b$, and ab mean all the same thing, viz., a multiplied by b; and, therefore, if $a = 3$ and $b = 4$, we shall have $ab = 12$, $5a = 15$, $5ab = 60$; and if also $c = 5$, $d = 0$, then

$$4ab + 3ac + 4d - 2b + 2abc - 3abcd = 48 + 45 + 0 - 8 + 120 - 0$$
$$= 213 - 8 = 205.$$

7. The number, whether positive or negative, prefixed to any algebraical quantity, is called its *coefficient*; thus 3 is the coefficient of $3a$, -7 of $-7ax$, &c.

If no number is expressed, the coefficient is understood, being 1, since a means *once* a.

Ex. 1.

If $a = 6$, $b = 5$, $c = 4$, $d = 3$, $e = 2$, $f = 1$, and $g = 0$, find the numerical values of the following expressions:

1. $a + 2b + 3c + 4d + 3e + 2f + g$.
2. $2a + b - 3c + 4d - 5f + 6g$.
3. $3b - 4a - 6c + 7d + 2e - 4g$.
4. $-3a + 2b + 3c - 2e + f$.
5. $ab + 5bc - 4de + 5fg$.
6. $4ag - 3bf + 4ce - ad$.
7. $-3ab - 2ac + 4bc - abc$.
8. $5ab - 8ac + 15cde - 14aef$.
9. $33ab - 19cd + 22abg - 13cdef$.
10. $abcd - 2bcde + 3cdef - 4defg$.

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8. The sign ÷ (*by*) denotes that the quantity which stands *before* it is to be divided by that which *follows* it; but, most frequently, to express division, the quantity to be divided is placed over the other with a line between them, in the form of a fraction.