ELEMENTS OF ALGEBRA, FOR THE USE OF ST. PAUL'S SCHOOL, SOUTHSEA, AND ADAPTED TO THE GENERAL OBJECTS OF EDUCATION

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Trieste

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PREFACE.

THE design of this little work is to present to the *young* Student the principles of Algebra in the most compendious and simple form. The Author has accordingly introduced nothing but what is absolutely necessary, and endeavoured to state the Rules and the Proofs of them in the plainest manner.

The arrangement of Equations will be found different from that usually adopted: but, as they are placed (see Pp. 15, 26, 39) as soon as the Student has learnt the rules necessary for their solution, the change will be found advantageous in leading the Student to an early application of his knowledge.

A copious collection of Examples will shortly be reprinted, and combined with this work, will, it is hoped, enable the Student to acquire a thorough acquaintance with the Theory and Practice of Algebra.

SOUTHSEA, HANTS,
July 1, 1840.

DEFINITIONS.

In Algebra the magnitudes of quantities are denoted by *letters*, and their relations by *signs*.

A letter from the *beginning* of the alphabet as a, b, c, &c. denotes a quantity whose value is *known* : from the *end* as x, y, z, denotes one whose value is *unknown*.

The signs are as follows:

$+$, *plus*, signifies *addition*: thus $a+b$ means b added to a.

$-$, *minus*, signifies *subtraction*: thus $a-b$ means b subtracted from a.

$\times$, *into*, signifies *multiplication*: thus $a \times b$ means a multiplied by b.

Sometimes a point is used instead of $\times$: thus $a.b.c$ for $a \times b \times c$. Often and especially with single letters $\times$ is omitted: thus abc for $a \times b \times c$.

$\div$, *by*, signifies *division*: thus $a \div b$ means a divided by b. More usually the dividend is placed over the divisor with a line between them: thus $\frac{a}{b}$ means a divided by b.

$\sqrt{}$, *root of*, signifies the *extraction of a root*: a figure over the $\sqrt{}$ implies the particular root, and when no figure is expressed 2 is understood: thus $\sqrt{a}$, $\sqrt[3]{a}$, $\sqrt[4]{a}$ mean the *second*, *third*, *fourth root* of a.

( ) a *bracket*, signifies that the quantities it includes are to be considered as *one* term: thus $-(a+b)$ means that the whole quantity $a+b$ is to be subtracted.

A line drawn over, means the same: thus $-\overline{a+b}$ means the same as $-(a+b)$.

$=$ *equal to*, signifies *equality*: thus $x=a-b$ means that x is *equal to* $a-b$.

There are other signs: as $>$ *greater than*: $<$ *less than*: $\because$ *because*: $\therefore$ *therefore*.

TERMS.

A *coefficient* is the number prefixed to a quantity and expresses the number of times it is taken: thus in $2a$, $7xy$, which imply *twice* a and *seven* times xy, the coefficients are 2, 7.

When no coefficient is expressed, 1 is to be understood: thus a, xy mean $1a$, $1xy$.

A *letter* whose value is *known* is often the coefficient of one whose value is *unknown*: thus of ax and by, a and b are the coefficients.

The *power* of a quantity denotes the number of times it is multiplied by itself: thus the 2nd, 3rd, 4th power of a mean a multiplied by a, *once*, *twice*, *three times*.

The *index*, is a small figure placed over the right hand of a quantity to denote the power: thus

a^2 (which stands for $a\times a$) denotes the 2nd power of a
a^3 (. . . . . $a\times a\times a$). . . . . 3rd . . . .
a^7 (. . . . . . $a\times a\times a\times a\times a\times a\times a$) . . . . 7th . . . .

If the *index* be *fractional*, the *denominator* denotes the *root* taken, and the *numerator* the *power* to which the quantity is raised: thus

$a^{\frac{1}{2}}$ denotes the 2nd root of the 1st power of a.
$a^{\frac{3}{4}}$ . . . . 4th. . . . . 3rd. . . . . a.

Hence $a^{\frac{1}{2}}$, $a^{\frac{1}{3}}$, $a^{\frac{2}{3}}$ mean the same as $\sqrt{a}$, $\sqrt[3]{a}$, $\sqrt[3]{a^2}$.

Positive quantities are those whose signs are $+$: as $+2a$, $+10ax$.

Negative quantities are those whose signs are $-$: as $-2a$, $-10ax$.

When no sign is expressed, $+$ is understood: thus $2a$ means $+2a$.

$+$ is omitted only when a quantity stands *alone*, or at the *beginning* of an expression: thus we write $3a$ not $+3a$: $a+b-c$ not $+a+b-c$.

Quantities have *like signs*, when the signs are all +, or all −: as $7a$, $6b$: or $-6x, -y, -10a$.

Quantities have *unlike signs*, when some of the signs are +, and some −: as a, $-3b$, $7c$.

Like quantities are those which have the *same letters* with the *same indices*: as $5a$, $7a$: and a^2x, $16a^2x$, $-4a^2x$.

Unlike quantities are those which have *different letters*: as $3a$, $2b$: or the *same letters* with *different indices*: as $3ax^2$, $2a^2x^3$.

A *Term* is one of any quantities connected by + or −: thus in $a+2b-3c$ the terms are a, $2b$, $-3c$.

A *simple* quantity consists of *one* term: as $2a$.
A *binomial* . . . . 2 terms: as $2a+b$.
A *trinomial* . . . . 3 terms: as $2a+b-c$.
A *quadrinomial* . . . . 4 terms: as $2a+b-c+d$.
A *multinomial* of more than 4 terms.

NOTATION.

Notation is the finding the Numerical value of an Algebraical expression.

RULE. For the letters substitute their given values, and reduce the expression to its simplest form.

Ex. 1. If $a=6$. $b=5$. $c=4$.

Find the value of $\frac{a^2b}{a+3c}+c^3$.

$$\frac{a^2b}{a+3c}+c^3=\frac{6^3\times 5}{6+3\times 4}+4^3=\frac{216\times 5}{6+12}+64=\frac{1080}{18}+64$$

$=60+64=124$.

Ex. 2. Find the value of $a^2\times(a+b)-2abc$.
$a^2\times(a+b)-2abc=6^2\times(6+5)-2\times 6\times 5\times 4=36\times 11-240=396-240=156$.

Ex. 3. Find the value of $\sqrt{(2a^2-\sqrt{2ac+c^2})}$.
$\sqrt{(2a^2-\sqrt{2ac+c^2})}=\sqrt{(2\times 6^2-\sqrt{2\times 6\times 4+4^2})}=\sqrt{(2\times 36-\sqrt{48+16})}=\sqrt{(72-\sqrt{64})}=\sqrt{(72-8)}=\sqrt{64}=8$.