RAPID ARITHMETIC: QUICK AND SPECIAL METHODS IN ARITHMETICAL CALCULATION TOGETHER WITH A COLLECTION OF PUZZLES AND CURIOSITIES OF NUMBERS; PP. 5-184

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649686575

Rapid Arithmetic: Quick and Special Methods in Arithmetical Calculation Together with a Collection of Puzzles and Curiosities of Numbers; pp. 5-184 by T. O'Conor Sloane

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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RAPID ARITHMETIC

QUICK AND SPECIAL METHODS IN ARITHMETICAL CALCULATION TOGETHER WITH A COLLECTION OF PUZZLES AND CURIOSITIES OF NUMBERS

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NEW YORK
D. VAN NOSTRAND COMPANY
EIGHT WARREN STREET
1922

PRINTED IN THE UNITED STATES OF AMERICA

PREFACE.

There are many things in arithmetic which receive little or but scant treatment in the ordinary text books. If one method of doing an operation is given, it is considered enough. But it is certainly interesting to know that there are a dozen or more methods of adding, that there are a number of ways of applying the other three primary rules, and to find that it is quite within the reach of anyone to add up two columns simultaneously. The multiplication table for some reason stops abruptly at twelve times; it is not hard to carry it on to or at least towards twenty times. Taking up the question of exponents, it is not going too far to assert that many college graduates do not understand the meaning of a fractional exponent, and as few can tell why any number great or small raised to the zero power is equal to one, when it seems as if it ought to be equal to zero.

The multiplication table can be made to give the most curious relations between its constituent figures and quantities, and of these only a part are given here, for one can play a regular game of solitaire with the multiplication table.

The book now in the reader's hands has been a wonderfully interesting work in its preparation. The sources of information and the authorities appealed to were many and in a number of cases were little known. The collection of the matter presented here was a sort of gleaning, picking

up what others had left. It was also a selective task, the accumulating of the best from many sources.

A reference to the table of contents will show that this preface tells only of a small part of what is to be found in the book. In a certain sense this work is a supplement to the ordinary text book of arithmetic. But it is more than that; it will be found of practical application in real work, for by applying the methods to be found in its pages a greater command of arithmetical operations will be acquired and quick ways of calculating will result.

Much that is amusing in the way of oddities and recreations in the science of numbers will be met with in its pages.

The compiler hopes that his mixture of the useful with the lighter phases of his subject will prove acceptable to the reader.

cation. It is liable to cause confusion, by being taken for the decimal point, yet it is very frequently employed.

If multiplications are set down in full, the upper quantity is called the multiplicand, from the Latin, meaning "to be multiplied"; the lower quantity is called the multiplier; and when the operation is completed the result is called the product. There is no reason for placing the multiplicand above the multiplier; they can change position and rôles without affecting the result of the calculation.

Division is indicated in several ways. One is by a horizontal bar or to save space a diagonal one. The number above the bar is called the dividend, from the Latin, meaning "to be divided"; the number with which it is to be divided is placed below the bar; it is called the divisor. Thus $\frac{6}{3}$, or what is the same thing, $6/3$ indicates 6 divided by 3. The result of a division is called the quotient, from the Latin, meaning "how often."

Another sign of division is possibly derived from this one; it is a horizontal bar with one point over its center and one below its center. $6 \div 3$ indicates 6 divided by 3.

The colon, :, is a sign of ratio and hence of division, but is not used, simply to indicate division, except in special cases.

The horizontal or oblique bar is not always admitted to be the sign of division; the claim is sometimes made that there is a difference between such expressions as $2 \div 4$ and $\frac{2}{4}$. The latter is taken as indicating a fraction only. But if we take such an expression as a/b, it is hard to see how it can be expressed except as "a divided by b." In the case of numbers the alternative fractional nomenclature is always available, as "two fourths" in the expression or fraction, $\frac{2}{4}$.

Whatever name is given it, $\frac{2}{4}$ means and indicates the division of 2 by 4.

The indication of the higher power of a number is a small figure placed above and to the right; it is called an exponent; 4^2 means the square of 4, which is 16; 5^3 means the third power or cube of 5, which is 125. The little figures, 2 and 3, are exponents, in these instances, of 4 and of 5 respectively.

The term "square" is an abbreviated way of expressing the second power; the term "cube" is the same for the third power; there are no other abbreviations of power expressions.

The radical sign indicates the root of a number. By itself it indicates the square root; if any other root is to be indicated the exponent is placed over it to the left. $\sqrt{16}$ means the square root of 16 which is 4; $\sqrt[4]{16}$ means the fourth root of 16, which is 2.

When there are several numbers required to express a quantity the combination is called an "expression." $2 + 3$ and $3 + 5$ are expressions.

The sign of equality is a pair of horizontal bars parallel to one another, $=$; they read "equal" or "equals." Thus to express the result of adding two quantities, say 2 and 3, we would write, $2 + 3 = 5$, which reads 2 plus 3 equal 5.

A statement such as the above, affirming the equality of two quantities or expressions, is called an equation and sometimes a formula.

Inequality is indicated by a V-shaped symbol placed on its side; the quantity next the apex is stated to be the smaller. $7 > 2$ means that 7 is greater than 2, or that 2 is less than 7. Both come to the same thing; the sign can face the other way; $2 < 7$ means that 2 is less than 7.

Two colons, placed one after the other, are the central sign of a proportion and are read "as," while in the same proportion the single colon is read "is to"; thus $2:4::4:8$ reads 2 is to 4 as 4 is to 8. Sometimes the equality sign, $=$, is used as the central symbol. If this is done in the above proportion we would have: $2:4=4:8$.

Taking the colon as the sign of division our last proportion would read 2 divided by 4 equal 4 divided by 8, which is perfectly correct, and expresses the relation existing between the members of a proportion. The double colon is never taken as a sign of equality, though it might be.

A parenthesis expresses the fact that the quantities within the parenthesis are to be taken as a group and to be treated as a single or individual quantity. $7-(2+3)$ means that the sum of 2 and 3 is to be subtracted from 7; this gives a remainder of 2. The same numbers without the parenthesis, $7-2+3$ tell us that 2 is to be subtracted from 7 and that 3 is to be added; the result is 8. The parenthesis brings about a totally different result.

Multiplication and division signs take precedence of addition and subtraction signs; the first two signs unite the numbers between which they are placed, as if they were in a parenthesis. Thus $12-10\div 2$ indicates that 10 is to be divided by 2 and the quotient is to be subtracted from 12; this gives 7, as the result. In like manner $4+6\times 3$ indicates that 3 times 6 are to be added to 4, which gives 22; 6×3 act as if in a parenthesis.

Decimal Fractions

A decimal fraction in the broad sense is a fraction whose denominator is a power of 10; $\frac{1}{10}$, $\frac{3}{100}$ and