THE TREE OF MATHEMATICS — GLENN JAMES (1951)

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1. FUNDAMENTALS OF BEGINNING ALGEBRA

1.1 ALGEBRA MATH = LANGUAGE ⇒ LEARNING & UNDERSTANDING

1.2 ALGEBRAIC STATEMENT OF ADDITION: ARITHMETIC WE USE NUMBERS, FROM 0 to 9, AS IN ALGEBRA WE USE LETTERS TO GENERALIZE ARITHMETIC:

- 3+5, OR 4+7 COULD BE DENOTED AS: a+b

1.3 ALGEBRAIC STATEMENT OF MULTIPLICATION:

- 3×5, OR 3×7 AS ALGEBRAIC STATEMENT: 3×a OR 3a

THEN IF a=5, 3a=15; OR IF a=7, 3a=21, ETC.

- 4×3, OR 6×7 AS ALGEBRAIC STATEMENT: a×b OR ab

THEN IF a=4 AND b=3, ab=12; OR IF a=6 AND b=7, ab=42.

1.4 FURTHER SIMPLIFICATION BY USE OF ALGEBRAIC LANGUAGE:

- 5=3+8, OR 5×2+7 AS ALGEBRAIC STATEMENT: 5a+b

THEN IF a=3 AND b=8, 5a+b=5×3+8=23; ETC.

- MULTIPLICATION AND SUBTRACTION:

3×2−4, OR 3×5−7 AS ALGEBRAIC STATEMENT: 3a−b

THEN IF a=2 AND b=4 3a−b=3×2−4=2; ETC.

- Addition of Products:

2×3+3×4, OR 2×4+3×6 AS ALGEBRAIC STATEMENT: 2a+3b

THEN IF a=3 AND b=4, 2a+3b=2×3+3×4=18; ETC.

- SUBTRACTION OF PRODUCTS

3×4−2×3, OR 3×2−2×1 AS ALGEBRAIC STATEMENT: 3a−2b

- PRODUCTS OF PRODUCTS:

(4×2)×(2×3)=4×2×2×3 AS ALGEBRAIC STATEMENT: 4a×2b

SINCE a AND b REPRESENT NUMBERS, WE CAN REARRANGE THE NUMBERS AND LETTERS AS WE PLEASE, THAT IS:

4a×2b=4×2×a×b=8ab

- Quotients of Products

$\frac{2\times12}{3\times4}$; $\frac{2\times9}{3\times2}$ AS ALGEBRAIC STATEMENT: $\frac{2a}{3b}$

THEN IF a=12 AND b=4, $\frac{2a}{3b}=\frac{2\times12}{3\times4}=2$

1.5 MULTIPLICATION OF A SUM:

ENGLISH STATEMENT: THREE TIMES THE QUANTITY FOUR PLUS SEVEN.

ARITHMETIC STATEMENT: 3(4+7)=3×11; OR 3×4+3×7=12+21=33

ALGEBRAIC STATEMENT: a(b+c)=ab+ac