Notation

In deriving the cubic formula, like the quadratic formula but for cubic equations, Girolamo Cardano was hampered by a lack of notation. [1] It took genius to solve the problem as posed. For example, how would you solve the following special case of the cubic equation, helpfully translated from Renaissance Italian?

cube plus thing equals number

In modern notation, this is the following.

$$x^3 + x = k$$

Just as language shapes our thinking, so does notation. The relation between the two terms on the left is captured by the exponent 3, saying the first term is three copies of the second term multiplied together. No such notation existed for Cardano.

The French mathematician Viète made a huge contribution by introducing letters for numeric quantities, yet he had little concept of exponents. Not until the 1600s and 1700s did exponents slowly take their modern meaning and notation.

Notation for the operators, such as "+", was another innovation. And "=" came about because its inventor could think of no symbol better expressing equality than a pair of parallel lines.

Consider the simple quadratic equation, which in modern notation can be written

$$x^2 + bx = k$$

but before modern notation was the following.

square plus number times thing equals number

Now derive the quadratic formula from that obscurity. There were mathematicians who succeeded in so doing.

What is not discussed above is that algebra itself had not been invented yet, quite aside from the lack of notation. Cardano had to derive the cubic formula geometrically, considering actual shapes such as geometric cubes, and then had to translate that result into a primitive notation. A simple algebraic path from one step to the next, understandable by any high school algebra student, was closed to Cardano and other research mathematicians of the 1500s.

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[1] As were Tartaglia, who found a partial solution, and Del Ferro.