FUNCTIONS AND MATHEMATICS

BY JAMES D. NICKEL

The idea of a function is one of the most powerful mathematical tools ever conceived of by man made in God's image. This concept, the seeds of it are apparent in many ancient civilizations, budded into a flower in Christian Europe in the 14th century. During this century, medieval scholars, primarily Nicole Oresme (1323-1382), developed two methods of expressing functional relationships.

The first method was type of "word-algebra" (now called *syncopated algebra*[1]) that was borrowed from a 9th century Arabic scholar named al-Khowarizmi[2] and used in describing the mechanism of motion (e.g., distance traveled in a given time). By this procedure, medieval scholastics formulated a *general* theory of motion by the use of letters of the alphabet instead of numbers for the changing, or variable, quantities (e.g., time and distance). They described the quantities of addition, division, multiplication, etc. performed on these quantities in words instead of being represented by symbols as in modern algebra.

Second, medieval scholars developed a geometric model or grid-like map whereby they could picture the relationship between the variables (e.g., distance and time) of a function.[3] This representation of a function was a forerunner of the coordinate graph (the *union* of two *diverse* mathematical topics, i.e., Geometry and Algebra), the inventor of which is usually identified in our history books as the French philosopher and mathematician René Descartes (1596-1650).

> The point which I now want to make is that this dominance of the idea of functionality in the abstract sphere of mathematics found itself reflected in the order of nature under the guise of mathematically expressed laws of nature. Apart from this progress of mathematics, the seventeenth century developments of science would have been impossible.
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> Alfred North Whitehead, *Science and the Modern World* (London: Free Association Books, [1926] 1985), p. 40.

According to the mathematician Tobias Dantzig:

> Algebra … enables one to transform literal expressions and thus to paraphrase any statement into a number of equivalent forms … it is this power of transformation *that lifts algebra above the level of a convenient shorthand* … the literal notation made it possible to pass from the individual to the collective,

[1] Historically, algebra developed in three stages: (1) rhetorical (all mathematical relations expressed in words), (2) syncopated (some mathematical relations expressed in symbols and others in words), and (3) symbolic (all mathematical relations expressed in symbols).

[2] Our word "algebra" comes from a book written by Mohammed ibn Musa al-Khowarizmi (ca. 780–ca. 850) who used the Arabic word *al-jabr* (originally meant to describe someone who, as a medical practitioner, was a "bone-setter") to denote the transposition of terms from one side of an equation (originally pictured as a "numeric" balance-scale) to the other.

[3] Oresme was the pioneer in the development of the idea of a function and its representation on a geometrical grid. Working at the Sorbonne in Paris, France, his writings formed textbooks that subsequent educators passed down, generation after generation, until Descartes, in the 17th century, studied them in his French schooling.

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from the 'some' to the 'any' and the 'all'…. It is this that made possible the general theory of functions, which is the basis of all applied mathematics.[4]

Mathematician Nathan Court continues with the same theme:

"The notion of number and the idea of space seem so far apart, qualitatively so different that the correspondence between algebra and geometry revealed by Descartes' invention is philosophically as far reaching as it is unexpected. This correspondence goes to show that the various concepts which we elaborate starting with different kinds of perception may not be as far apart as their origins would imply. Furthermore this correspondence may be indicative of the 'unity of knowledge' or of the unity of the external world …."[5]

> The possibility of an applied mathematics is an expression, in terms of natural science, of the Christian belief that nature is the creation of an omnipotent God. This belief is what replaced the Greek conception of nature as the realm of imprecision with the Renaissance conception of nature as the realm of precision. The Platonism of Renaissance natural science is not fundamentally Platonic, it is fundamentally Christian. Christian thought is adapting Platonism to its own ends, or begetting upon Platonism an idea which Platonism proper would never have originated or even tolerated …. Christianity, by maintaining that God is omnipotent and that the world of nature is a world of God's creating, completely altered the situation. It became a matter of faith that the world of nature should be regarded no longer as the realm of imprecision, but as the realm of precision …. Galileo, the true father of modern science, restated the Pythagorean-Platonic standpoint in his own words by proclaiming that the book of nature is a book written by God in the language of mathematics …. Galileo is deliberately applying to nature the principle which Augustine laid down with regard to the Holy Scriptures, the book *par excellence* "written by the hand of God"; that whatever doubts may arise about the meaning of this or that passage, it has a meaning, and the meaning is true (*Confessions,* XII, 23-4).
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> R. G. Collingwood, *An Essay on Metaphysics* (1940), pp. 253-256.

[4] Tobias Dantzig, *Number: The Language of Science* (New York: Doubleday Anchor, [1930] 1954), p. 89.
[5] Nathan A. Court, *Mathematics in Fun and in Earnest* (New York: Dover, [1935] 2006), p. 17.

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Court continues his analysis with some questions.[6]

- "As a fitting conclusion to the discussion of the unity between number and space we may consider the question: What is it that makes such a unity possible?"
- "What is the profound common residue that accounts for this relation?"
- "Such an investigation would further enlighten us to the nature of knowledge itself."

Court does not answer the question because he cannot. The profound common "residue" [what remains] that accounts for unity and diversity that functional analysis reveals is the Triune God of Scripture, the ultimate "Unity in Diversity." Court, by his no answer affirms what happens when the truth of God is suppressed (cf. Romans 1:18ff).

In the light of history and the Biblical Christian worldview, we understand the function concept in three contexts. *First*, functional analysis, combined with algebra, allows man to generalize (unify) a wide variety (diversity) of patterns. Also, coordinate geometry unifies two diverse mathematical topics: algebra and geometry. Here we see the proximate "unity in diversity" principle illustrated in the powerful methods of mathematics.[7] *Second*, the idea of a function was initially connected to the mechanics of motion (what we now call Classical Physics). Hence, algebra and the study of functions relate primarily to the "search for patterns" in the movements of the physical creation. *Third*, the idea of a function is an intellectual tool that enables man, as a dominion steward under God, to both identify and use those patterns.

> "Logic or reason can be justified only in the equation that the fear of the Lord is the beginning (i.e., the substructure) of all knowledge."
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[6] *Ibid.*, p. 19.

[7] The justification of proximate "unity in diversity" is the ultimate "Unity in Diversity," the Triune God revealed in Scripture.

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