"**All is number**"

"All is number" is the motto of the Pythagorean School. This school was founded by the Greek mathematician and philosopher Pythagoras (ca. 580-500 B.C.) Pythagoras was born in Samos, a Greek island near Turkey. He is said to have traveled to Egypt and Babylon. Then he settled in Croton, in southern Italy, where he established his school.

The members of the school pursued the study of mathematics, philosophy, astronomy and music. They followed some strict rules concerning their eating and general conduct. The teachings of the school were kept secret from public. The knowledge was communicated to the students verbally and students were not allowed to write it down. The discoveries of the school were attributed to Pythagoras.

The core of the Pythagorean doctrine is that number is the essence of things. We can understand every thing by numbers only as every object has a number that is characteristic to it. Philolaus (fourth century B.C.), a member of the Pythagorean school, is reported to have said that "all things which can be known have number; for it is not possible that without number anything can either be conceived or known." [Heath, p. 67].

The Pythagoreans associated certain meanings and characters to numbers. They considered odd numbers as males and even numbers as females. To the Pythagoreans, one is the number of reason, two is the number of opinion, three is the number of harmony, four is the number of justice, five is the number of marriage, six is the number of creation, seven is the number of awe, and ten is the number of the universe.

But why "All is number". A couple of possible reasons were given. The first one is the Eastern influence. Having traveled to Egypt and Babylon, Pythagoras might have been influenced by numerology, which deals with numbers and mystical relations among them, that was common in these two regions. A second possible reason is to give an alternative view to the contemporary belief in Greek concerning the principles of things. At the time, it was believed that earth, air, fire and water are the four basic principles of things. This did not convince Pythagoras in explaining the principles of immaterial things. A third possibility comes from astronomy, a subject that was studied by Pythagoras. In studying stars, one observes that each constellation can be characterized by the number of stars composing it and the geometrical figure that thy form. The fourth possible reason comes from music. The members of the school practiced music. Pythagoras observed that musical notes produced from a vibrating string of some length could be characterized by (ratios of) numbers. Dividing a vibrating string by some movable object into two different lengths produced different types of musical notes. These notes are then described by the ratios of the lengths of the parts of the vibrating string. Explaining musical notes and describing stars by numbers may have then led the Pythagoreans to think that numbers can also be used to explain other phenomena.

This belief in numbers had an important impact in the development of mathematics. As numbers are essential in understanding every thing, the Pythagoreans devoted themselves in studying numbers more seriously. They classified numbers into even and odd, prime and composite, perfect and friendly. They also introduced "figurate

numbers", a method of representing numbers geometrically. One can say that number theory, as we know it today, was originated by the Pythagorean School. Other mathematical contributions of the Pythagoreans include the development of the theory of proportions, the discovery of the irrationals, the invention of the method of application of areas and the construction of the five regular solids: the cube, the tetrahedron, the octahedron, the icosahedron and the dodecahedron. One can then observe that the Pythagoreans did not study mathematics for the sake of mathematics; rather, they found mathematics a means to understand all existing things.

It is very important to point out that no mathematical writings of Pythagoras and the early Pythagoreans had survived. Many of what we know about the thoughts of the school was communicated to us by later members of the school like Philolaus (fourth century B. C.) and Archytas (ca. 428-365 B. C.) and by others, like Plato, who admired some of their teachings, and Aristotle, who analyzed critically what was attributed to the Pythagoreans.

Today, nobody denies the importance of numbers in understanding the world around us. By numbers and numerical relations expressed in mathematical equations, we are able to better interpret and understand many of the physical phenomena of this universe. This, in turn, reflects the degree of truth in the Pythagorean motto "All is number": even though our perception of the importance of numbers is different from that of the Pythagoreans.

References:

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