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Abstract

Mathematics has been considered as very important subject since ancient times. We find very elaborate proof of this in Vedas, which were compiled around 6000 BC. The concept of division, addition etc. was used even that time. Concepts of zero and infinite were also there. We also find roots of Beez Ganit in Vedas. When Indian Beez Ganit reached Arab, they called it Algebra. Algebra was name of the Arabic book that described Indian concepts. This knowledge reached Europe from there. This fact was well known to intellectuals of India, which is why they gave special importance to the development of Mathematics, right from the beginning. When this knowledge was negligible in Arab and Europe, India had acquired great achievements. This paper discusses development of mathematics in India from ancient time.

Key words : Mathematics, India, Mathematicians, History

The development of human civilization is accompanied by the development of mathematics. For civilization to flourish, stability in society and thoughts is most essential. Stability in thoughts comes only with the knowledge of mathematics. As the civilization prospers, the knowledge of mathematics is used in the daily life of the people. The earliest mathematical concepts developed are (i) the concept of form and shape, (ii) the concept of counting and numbers and (iii) the concept of measure of magnitude. Some of the marvelous architectures of ancient world can be considered as the gifts of mathematics and geometry. Mathematics has been considered as very important subject since ancient times. We find very elaborate proof of this in Vedas, which were compiled around 6000 BC. The concept of division, addition etc. was used even that time. Concepts of zero and infinite were also there. We also find roots of algebra in Vedas. When Indian Beez Ganit reached Arab, they called it Algebra. Algebra was name of the Arabic book that described Indian concepts. This knowledge reached Europe from there. And thus ancient Indian Beez Ganit is currently referred to as Algebra. This fact was well known to intellectuals of India that is why they gave special importance to the development of Mathematics, right from the beginning. That time this knowledge was negligible in Arab and Europe. India had acquired great achievements. People from Arab and other countries used to travel to India for commerce. While doing commerce, they also learnt calculation methods of India. Through them this knowledge reached Europe. From time to time many inquisitive foreigners visited India and they delivered this matchless knowledge to their countries. This will not be exaggeration to say that till 12th century India was the world Guru in the area of Mathematics.

Ancient Time (Before 500 BC) : Ancient time is very important in the history Mathematics. During this time different branches of Mathematics, such as Numerical Mathematics, Algebra, Geometrical Mathematics, were properly and strongly established. There are two main divisions in Ancient Time. Numerical Mathematics developed in Vedic Time and Geometrical Mathematics developed in Later Vedic Time.

a) Vedic Time (At least 6000 BC-1000 BC) : Numerals and decimals are clearly mentioned in Veda (Compiled at least 6000 BC). In the Richa Veda, Dwadash (12), Treeni (2),

Trishat (300) numerals have been used. This indicates the use of writing numerals based on 10. In this age, the discovery of zero and 10th place value method is great contribution to world by India. If zero and 10 based numbers were not discovered, it would not have been possible today to write big numbers. This is the second greatest achievement of human race after the discovery of Alphabets. This is not known for certain that who invented zero and when. But it has been in use right from the Vedic time. The importance of zero and 10th place value method is manifested by their wide spread use in today's world. This discovery is the one that has helped science to reach its current status. In the second section of earlier portion of Narad Vishnu Puran (written by Ved Vyas) describes mathematics in the context of Triskandh Jyotish. In that, numbers have been described which are ten times of each other, in a sequence (10 to the power n). Not only this but different methods of mathematics like Addition, Subtraction, Multiplication, Addition, Fraction, Square, Square root and Cube root etc. have been elaborately discussed. Problems based on these have also been solved. Tenth place value method dispersed from India to Arab. From there it got transferred to Western countries. This is the reason that digits from 1-9 are called hindsa by the people of Arab. In western countries 0, 1, 2, 3,4,5,6,7,8,9 are called Hindu-Arabic Numerals.

b) Later Vedic time (1000 BC-500 BC)

Shulv and Vedang Jyotish Time : Veda was very important while performing rituals. On the top of Veda different type of geomit (geometry word is derived from Sanskrit word geomit) were made. To measure those geometry properly, geometrical mathematics was developed. That knowledge was available in form of Shulv Sutras (Shulv Formulae). Shulv means rope. This rope was used in measuring geometry while making Vedis. The following excerpt from Baudhayan Shulv Sutra (1000 BC) is today known as Pythagoras Theorem. The following has been said in Baudhayan Shulv Sutra – In a Deerghchatursh (Rectangle) the Chetra (Area) of Rajju (hypotenuse) is equal to sum of squares of parshvamani (base) and *Triyangmani* (perpendicular). While Geometric Mathematic was developed for making Veda in Yagya, in parallel there was a need to find appropriate timing for Yagya. This needs led to development of Geotish Shastras (Astrology). They calculated time, position and motion of stars. By reading the book Vedanga Jyotish (At least 1000 BC), we find that astrologers knew about addition,



multiplication, subtraction etc. For example- Multiply the date by 11, then add to it the Bhansh of Parv and then divide it by Nakshatra number. In this way the Nakshtra of date should be told.

Surya Pragyapti Time : We find elaborated description of Mathematics in the Jain literature. In fact the clarity and elaboration by which Mathematics is described in Jain literature, indicates the tendency of Jain philosophy to convey the knowledge to the common people. Surya Pragyapti and Chandra Pragyapti (At least 500 BC) are two famous scriptures of Jain branch of Ancient India. These describe the use of Mathematics. Deerga vritt (ellipse) is clearly described in the book titled Surya Pragyapti. Deerga Vritt means the outer circle (Vritta) on a rectangle (Deerga) that was also known as Parimandal. This is clear that Indians had discovered this at least 150 years before Minmax (150 BC). As this history was not known to the west so they consider Minmax as the first time founder of ellipse. Jain gurus have described different branches of mathematics in a very through and interesting manner. They have described fraction, algebraic equation, series, set theory, logarithm, single sets. For logarithm, they have used terms like Ardh Aached, Trik Aached, and Chatur Aached. These terms mean log base 2, log base 3 and log base 4 respectively. Well before Joan Napir (1550-1617 AD), logarithm had been invented and used in India which is a universal truth.

Pre Middle Time (500 BC- 400 AD) : From the literature of Aryabhata, Brahmagupt of Middle Times, we can conclude that in this time too Mathematics underwent sufficient development. The book titled Vaychali Ganit discusses the following –the basic calculation of mathematics, the number based on 10, square, cube, rule of false position, interest methods, question on purchase and sale. The book has given the answer of the problems and also described testing methods. Vanchali Ganit is proof of the fact that even at that time (300 BC) India was using various methods of the current Numerical Mathematics. This is noticeable that this book is the only written Hindu Granit book of this time that that was found as a few survived pages in village Vaychat Gram (Peshawar) in 1000 AD. Roots of the modern trigonometry lie in the book titled surya siddhanta. It mentions zya (sine) otkram zya (versesine), and kotizya (cosine). The same word (zia) changed to "jaib" in Arab in deciding the position, motion etc. of the spatial planets. Indians developed rules of addition subtraction, multiplication with the sign (+, -, x). In this context it is important to notice the contribution of great mathematician Brahmagupt (628 AD). He said-the multiplication of a positive number with a negative number comes out to be a negative number and multiplication of a positive number with a positive number comes out to be a positive number. When a positive number is divided by a positive number the result is a positive number and when a positive numbers is dividend by a negative number the result is a negative number.

Indians used notation for squares, cube and other exponents of number. Those notations are used even

today in the mathematics. They gave shape to Beezganit samikaran (algebraic equations). They made rules of transferring the quantities from left to right or right to left in an equation. Right from the 5th century AD, Indians majorly used afore mentioned rules. For the first time in Greece world, the concept of Beez Ganit is described in books of (275 AD). By that time Indians were far ahead. This is worth noting that the shape and form of current Beez Ganit is originally Indian.

Middle Time or Golden Age (400 AD- 1200 AD) : This period is called golden age of Indian Mathematics. In this time great Mathematicians like Aryabhata, Brahmagupt, Mahaveeracharya and Bhaskaracharya who gave a broad and clear shape to almost all the branches of mathematics which we are using today. The Principles and methods which are in form of Sutra (formula) in Vedas were brought forward with their full potential, in front of the common masses. To respect this time India gave the name "Aryabhata" to its first space satellite. Aryabhata (499 AD) has described, in a very crisp and concise manner, the important fundamental principles of Mathematics only in 332 shlokas. His book is titled Aryabhattiya. In the first two section of Aryabhattiya, Mathematics is described. In the last two section of Aryabhattiya, Jyotish (Astrology) is described. In the first section of the book, he has described the method of denoting big decimal number by the alphabets. He was the first to use Vyutkram Zia (which was later known as Versesine in the West) in Trigonometry. He calculated the value of pi correct up to four decimal places.

Bhaskar (600 AD) did matchless work on indeterminate equations. He expanded the work of Aryabhata in his book titled Mahabhaskariya, Aryabhattiya Bhashya and Laghu Bhaskariya. The famous work of Brahmagupt (628 AD) is in his book titled Brahm-sfut. This book has 25 chapters. In two chapters of the book, he has elaborately described the mathematical principles and methods. He threw light on around 20 processes and behaviors of Mathematics. He described the rules of solving equation of Beezganit (algebra). He also told the solution of indeterminate equation with two exponents. Later Ailer in 1764 AD and Langrez in 1768 described the same. Bhaskaracharya second (1114 AD) has written excellent books namely Siddhanta Shiromani, Leelavati Beezganitam, Gola Addhaya , Griha Ganitam and Karan Kautoohal. Hec gave final touch to Numerical Mathematics, Beez Ganit (algebra) and Trikonmiti (Trigonometry).

This shows that Indian Mathematicians were far ahead of rest of the world and we need to recognize it.

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