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MATHEMATICS IN ANCIENT INDIA AND ITS RELEVANCE

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Abstract

"In this paper we will focus on mathematics and its development in ancient India, China and different other countries specifically in different centuries starting from thirteen centuries to twentieth century's".

When we attempt to define "Mathematics", we find ourselves encircled by unexpected limitations, and these limitations are still more in evidence when we change the term to "elementary mathematics". If mathematics mean that the abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial and numerical relation".

Seeking to tell the story of the genesis of mathenatics even before the period in which the science began to exist such a procedure will lead us back not only to the days when the human race was young but to the ages immediately antedating its appearances upon the eann and even further. If one should wish to reach an absolute zero from which to begain his narrative, he would soon find himself last in a maze of perplexities.

1. Development of Mathematics in Different Countries

For first time in mathematics and similarly in other fields, men began to ask fundamental questions such as - "Why the base angles of an isosceles triange are equal and why does a diameter of a circle bisect the circle?" The empirical processes of the ancient orient quite sufficient for the question how, no longer sufficient to answer these more scientific inquries of why. Some attempt at demonstrative method was bound to assert itself. We have no definite knowledge as to where mathematics first developed into anything like a science strong claims to priority and so has Egypt.

1.1 China

We have little positive knowledge of its earliest literature, the possibility of corruption of its texts being such as to cast doubts upon its extreme claims. Until native scholars develop a textual criticism common surate with that which has been developed in the ancient, this uncertainty will continue to exist. The historical period begins with the 8th century B.C., or, at the earliest, with the reign of Wu Wang, the martial Prince, in 1122 B.C. In beginning with China, therefore, it must not be thought that we should recognize the validity of all the claims that are of ten advanced for the antiquity of her science.

Basing his opinion upon later historical description of the primitive Astronomy of China, Professor Schlegel of the Hague, as already remarked, asserts that the chinese recognized the constellation's as early as 17000 B.C., which was about the close of the early stone Age. There is nothing imipossible in such a supposition, although it is in probable. The race had developed considerably by that time, and it may well have extended its poetic fancy to the giving of forms to groups of Stars which it had looked upon for thousands of years. Professor Sehlegel also fixes upon 14700 B.C. or an approximate date of the duodenary Zodiac, other Schoars asserting that 13000 B.C. is more probable and still others fixing upon 4000 B.C., a discrepancy that may well arouse skeptism as to the validity of any of these hypothesis. Schelegel also believes that there is evidence of the extended study of the celestial sphere in China in or about 14600 B.C.

While such claims are generally doubted by competent sinologists, it is quite likely that the Chinese developed some aequaintance with descriptive Astronomy at an early period, and that this development necessitated such knowledge of mathematics or the measure of time and angles and the use of farily large numbers. Reasonably well founded tradition gives the probable dates of Fun-hi, the reputed first emperor of China, or 2852-2738 B.C. and in his regin there were extensive Astronomical observations in this general period the Chinese are believed to have changed their Zodiac in to one of twenty eight animals.

1.2 India

When we pass from a consideration of Chinese mathematics to the mathematics of India, Babylonia and Egypt, we meet with the mental product of an entirely different type of people, or rather of two different types. These were two great branches of human race affecting the Western World on the one hand and India, Mesopotamia and certain adjoining regions on the other hand. The first of these branches is supposed to have wandered from the Northern Grasslands and constitutes what is known as the Indo-Eurpoeans. In the West, its members appear as Celts, Romans and Greeks, and in Asia minor it has several respresentative grous. In the East, this same stock is seen in the Medes, Persian and Hindus. The Eastern branch is properly designated as Aryan, from which we have the name "Iran" for Persia.

The people were generally highly imaginative, and their work in mathematics, developed along such lines as the theory of numbers, Geometry and Astronomy as well as in that of commerce. If the early mathematical achievements of the Chinese are uncertain as to date and importance much more so is the early programs of the Hindus. Not only are we without any satisfactory records of the remote past of there people, but we are not infrequently confronted by claims that are preposterous and that are recognized by Hindu Scholar themselves. The first edition of the surya siddhanta of the Swami Press at Meerut, for example, says that the work was "Compiled about 2,165,000 years ago" representing a period about four times as long as it is thought the human race has been in existence.

As to authentic records, India has none written before the first Mohammedan Invasion, C664 A.D. All that we know of her earlier history in what we can glean from her two great epics, the Mahabharata and the Ramayana, and from coins and a few inscriptions. The Mahabharata relates the skill in numerals possessed by the ancient heroes, and the inscriptions tell us something of the notation used by the Hindus two thousand years ago, but neither gives us any knoledge of the period closing a thousand years before our era. The Vedas, the sacred writings of India, lead us to understand that in this period some attention was given to astronomy, as was the case in contemporary. China, Mesopotamia and Egypt. All that we can say, therefore, about this period of Hindu Mathematics is that there is some evidence from ancient literature that in very early times India paid attention to astronomy and calculation just as was the case with other advanced people of that period.

2. Development of Mathematics in Different Century

2.1 Fibonacci and Thirteenth Century

At the threshold of the thirteenth century appeared Leonardo Fibonacci ("Leonardo, son of Bonaccio"), perhaps the most talented mathematician of the middle ages. Also known as Leonardo of Pisa. Fibonacci was born about 1175 in the commercial centre of Pisa, where his father was connected with the mercantile business. The father's occupation early roused in the boy as interest in arithmetic, and subsequent extended tripsto Egypt, sicily, Greece and Syria brought him in contact with eastern and Arabic mathematical practices throughly convinced of the practice. Superiority of the Hindu-Arabic method of calculation Fibonacci in 1202 shortly after his return home, published his famous work called the Liber abaci.

Fibnocci Sequence : $1,1,2,3,5, \ldots\ldots\ldots x,y,x+y \ldots\ldots\ldots\ldots\ldots,$

$F_n = F_{n-1} + F_{n-2},\ N \geq 2,\ F_o = 1,\ F_1 = 1$

2.2 The Fourteenth Century

The greatest mathematician of the period was Nicole Oresme, who was born in Normandy about 1323. He dies in 1382 after a career that carried him from a college professor to a bishop. He wrote five mathematical works and translated some of Aristotle. In one of his tracts appears the first known use of fractional exponents (not, of course in Modern notation), and in another tract he locates points by co-ordinates, thus foreshadowing modern co-ordinate geometry. A century later this tract enjoyed several printing and may have influenced Renaissance Mathematicians and even descarts.

2.3 Fifteenth Century

The first appearance in print of our'+' and '-' signs in an arithmetic published in Leipzing in 1489 by Johann Widman (born Ca. 1460 in Brhemia). Here the sign are not used as symbols of operator but merely to indicate excess and defiency quite likely the plus sign in a contraction of the Lating work et, which was frequently used to indicate addition, and it may be that the minus sign in contracted from the abbreviation in for minus. Other plausible explanations have been offered the '+' and '-' signs were used as symbols of algebric operation in 1514 by the Dutch mathematician Vander Hoecke but were probably so used earlier.

2.4 Development in Sixteenth Century

Our account of the mathematics of the sixteenth century would not be complete with out a brief mention of some of the other contributors of there are the Mathematicians Clalius, Catatdi, and Stevin, and the mathematical Astronomes, Copernicus, Rhaeticus, and pitiscus. Chritopher Clavius was born in Bombery, Germany in 1537 and died in Rome in 1612. He added little of his own to mathematics but probably did more than any other German scholar did of the century to promote a knowledge of the subject. He was a gifted teacher and wrote highly esteemed text books on arithmetic (1583) and Algebra (1608) in 1574 he published an edition of Euclid's Elements which is Valuable for its extensive Scholia. He also wrote on trigonometry and Astronomy, and played an important part in the Greogorian reform of the calendar. As a Jesuit, he brought honor to his order. Pietro Antonio Cantaldi was born in Bologna in 1548, taught mathematics and Astronomy in Florence, Perugia and Bologna, and died in the city of his birth in 1626. He wrote a number of mathematical works among which are an arithmetic, a treatise on pertect numbers an edition of the first six books of the Elements, and a brief treatise on Algebra. He is credited with taking the first steps in the theory of continued fractions, in summarizing the mathematical achievements of the sixteenth century, we can say that symbolic algebra was well started computation with the Hindu-Arabic numerals become standardized, decimal fractions were developed, the cubic and quarbic equations were solved and the theory of equations generally advanced negative number's becoming accepted, trigonometry was perfected and systemized and some excellent tables were computed the stage was set for the remarkable strides of the next century.

2.5 The Seventeenth Century

The seventeenth century is outstandingly conspicious in the history of mathematics Early in the century Napier revealed his invention of Logarithms, Harriot and Oughtred contributed to notation and codification of Algebra, Galileo fainded the science of dynamics, and Kepler announced his laws of Planetory Motion Later, in the century Desargues and Pascal opened a new field of pure geometry, descrates, launched modern analytic geometry, Fermat laid the fundations of modern number theory and Huygens made distinguished contributions to the theory of Probability and other field.

Then, towards the end of the century, after a lost of seventeenth century mathematicians had prepared the way the epoch-making creation of the Calculus was made by Newton and Leibnitz. We thus see that during the seventeenth century, many new and vast fields were opened up for mathematical investigation.

Galileo:

There are two outstanding astronomers who contributed notably to mathematics in the early part of the seventeenth century. The Italian Galileo Galilei, and the German, Johann Kepler Galileo arrived at the law that the distance a baby falls is proportional to the square of the time of falling in accordance with the familiar formula $S=½gt^2$. Because of local controversies, Galileo continued his experiments and his teaching, and won a widespread fame. It was while at Padua that Galileo heared of the discovery in about 1607 of the telescope by the lens grinder Johann Lippersheim of Holland he set about making some instrument of his own, producing one that had a magnifying power of more than 30 diameters. With his telescope he observed Sun spots, the mountains on the Moon, the phases of Venus, Staturn's rings, and the four bright satellites of Jupiter.

2.6 Eighteenth Century

The two greatest mathematician of the eighteenth century were Euler and Joseph Louis Lagrange (1736-1718) and which of the two is to be accorded first place is a matter of debate that often reflects the varying mathematical sensitivities of the diebaters. Lagrange was born in Turin, Italy.

We conclude our very brief survey of eighteenth century mathematics by noting that while the century witnessed considerable further development in such subjects as trigonometry, analytic geometry, Calculus, theory of numbers, theory of equations, probalility, differential equations and analytic mechanics, it witnessed also the creation of a number of new subjects, such as actuarial science, the Calculus of variations, higher functions, descriptive geometry and differential geometry.

2.7 Development of mathematics in Nineteenth Century

Three significant events of the nineteenth century. The three profoundly significant mathematical events occurred during the nineteenth century-one in the field of geometry, one in the field of algebra and one in the field of analysis. The event in geometry was the first one of the three to occur. It was the discovery about 1829, of a self consistent geometry different from the geometry of Euclid. The immediate consequence of the discovery of this first Non-Euclidean geometry was, of course, the final settlement of the ages-old problem of the parallel postulate. We shown to be independent of the other assumptions of Euclidean geometry from its traditional hold. In the early nineteenth century, algebra was considered to be simply generalized arithmetic. It was the early nineteenth century British School of Algebraists - George Peacock (1791-1858). Duncan Farquharson Greogory (1813-1844), Augustus De Morgan (1806-1871), and other who first noticed the presence of structure in Algebra, such as the commutative and associative laws of addition and multiplication, and the distributive law of multiplication over addition. The English mathematician Arthur Cayley (1821-1895) devised his matrix algebra which is an example of a non-commutative algebra. By developing algebras satisfying strucrural laws different from those boeyed by common algebra, these men opened the flood gates of modern abstract algebra.

The third of the three profound mathematical events of the nineteenth century was in the field of analysis and was slow in materializing; it was the so-called arithmetization of analysis. We have seen that some mathematicians of the eighteenth century became alarmed over the deepening crisis in the foundations of analysis. A great forward step was made in 1821, when the French mathematician Augustin-Louis Cauchy successfully executed D' Alembert's suggestion, by developing an acceptable theory of limits and then dfeining convergence, Continuity, differentiability, and definite integral in terms of the limit concept. It is essentially for these definitions that we find in the more carefully written of today's elementary text books on the Calculus. In the late nineteenth century, with the work of Richard Dedekind (1831-1916), Georg Cantor (1845-1918), and Guiseppi Peano (1858-1932), these foundations were established in the much simpler and more basic system of natural numbers i.e. these men showed how the real number system can be derived from a postulate set for the natural number system. At the end of nineteenth century, with the development of the idea of a branch of mathematics as an abstract body of theorems deduced from a set of pustulates, each geometry, from this point of view, a particular branch of mathematics.

The history of the term function furnished another interesting example of the tendency of mathematicians to generalize and extend their concepts of work "function", in its Latin equivalent, seems to have been introduced by Leibnitz in 1694 at first as a term to denote any quantity connected with a curve, such as the co-ordinates of a point on the curve, the slope of the curve, the radius of curvature of the curve and soon. Johann Bernoulli by 1718, had come to regard a function as any expression made up of a variable and some constants, and Euler, Somewhat later, regarded a function as any equation or formula involving variables and constants. This latter idea is the notion of a function formed by most students of elementary mathematics courses.

The notation of the function pervades much of mathematics, and since the early part of the present century various influential mathematicians have advocated the employment of this concept as the unifying and central principle in the organization of elementary mathematics courses. The concept seems to form a natural and effective guide for the selection and development of textual material. There is no doubt of the value of a mathematics dtudent's early acquaintance with the function concept.

In the twentieth century Srinivasa Ramanujan lyengar (1887-1920), an Indian mathematics wizard, occupies an unique position in the history of mathematica. Although he had little formal education, Ramanujan has left a memorable imprint on mathematical throughts which fascinate and stimulate not only research mathematicians but also school students and even common people, with which he differed from great many mathematicians world over.

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