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AN ARTICLE ON WEEDING OF ALGEBRA AND GEOMETRY CALLED GEOMETRICAL ALGEBRA OR ANALYTIC GEOMETRY: A STUDY

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Abstract: *The present paper tries to discuss and compare the discoveries made in past, about the new branch Geometrical Algebra" of mathematics by ancient mathematicians of different countries of the world. With its historical sketch and draw conclusion in the favor of ancient Hindu savants for its organization.*

Keywords: - Algebra, Geometry, Ancient and Mathematicians.

1. Introduction

Algebra: - Algebra was named as Beeja and Kama by Indian mathematicians-Brahmagupta**,** mahavira, Bhaskara etc. The word 'Algebra' is described form the title of the book" Aljebar wal AJmugabalah", written about 825 A.D by an Arab mathematician named-Mohammad Ibn AJ-khowarizmi" of Bagdad.

Geometry: - The word Geometry is made up of two Greek words- Geo and Mete. Geo means the earth and Mete means measurement. Geometry was originated by the Egypts and Bebiloniais. The formula for finding areas of some special rectilinear figures was established by Bebiloniais and written in old Mathematics of Bebilone named "Rhind papyrus" in 1650 B.C. The Indians (2500 B.C-1750 B.C) in Harhappa and Mohanzodarho civilizations knew Geometry.

In Vedic Civilization, Geometry was originated for making altars and fire-pits. The rope used for essential measure in altars was named as "sulba". Baudhayan's Sulba-sutra is the oldest amongst all Sulba-sutras, which was made in 8oo B.C. Pythagoras' Theorem .is supported by Sulba-Sutras.

Later on, the knowledge of geometry reached the Greeks from Egypts. Thales, a merchant of Melatus city (640 B.C- 546 B.C) earned a lot of money and determined to expand his life in study and tourism- wandering. He became interested when he was at tour in Egypt. He taught Geometry to his friends after returning in Greek. .

Pythagoras was the most popular among t the disciples of Thales (580 B.C-500B.C).

Euclid (300B.C), the Greek mathematician, was the pioneer of proving the facts of Geometry by deductive reasoning. All the works of Geometry by Euclid are piled in 13 parts of the book - "The Elements'', written by Euclid.

From among main Indian contributors to Geometry were Brahma Gupta (598 A.D), who discovered formula for finding the area of Cyclic quadrilateral in terms of its sides and semi-perimeter ; Bhaskara (ll14A.D), Who proved P)1hagoras' Theorem by method of separation and Aryabhatta (476A.D)who discovered formula for finding area of isosceles triangles and volumes of Pyramids .

The Geometry discussed till now is called Euclidean Geometry. It starts with certain concepts such as points, lines and planes; it also attributes certain properties to them called axioms or postulates, which are suggested by physical experiences and then uses methods of deductive logic to derive a no. Theorems, which are the main fruit of mathematical activities and also revealed to us the interesting and useful properties of the geometric figures under Consideration.

This approach was first presented by the Greek mathematician Euclid (300B.C) in his famous treatise "Elements" and is being followed since then.

The Euclid's geometry made no use *of* the process of Algebra, and so is called the "Synthetic approach to Geometry".

First of all, the French philosopher and Mathematician Rene Descartes (1596-1665A.D) used algebra and its process in Geometry in his .book "La Geometric" published in 1637. In this book he introduced the analytic approach as against synthetic approach, by systematically using algebra in the study of Geometry. This was achieved by representing points in the plane by ordered pairs of real numbers called Cartesian Co-ordinates, and representing lines and curves by algebraic Equations .

This weeding of Algebra and Geometry 1s known as "Analytic Geometry" or "Co- ordinate Geometry".

Later on, by Riemann, it was suggested 'that process of Differentiation can be applied to curves (space) and so a new branch of mathematics called "Differential Geometry" or "Riemannian Geometry" was developed.

The branch of geometry which is treated with the help of differential _calculus is called "Differential Geometry"

In differential Geometry (D.G), we study about space curves and surfaces.

As the geometric character of the curves and surfaces varies continuously, calculus is applied to study the properties of space curves and surfaces in nhd of a point.

The study of the properties of curves and surfaces of an arbitrary small nhd of a point is called Local Geometry. If however, a property pertains to geometric Configuration (curve surface) as a whole; it is called "Global or Macroscopic or Algebraic Geometry".

In Differential Geometry, the local geometry of curves and surfaces are mainly studied.

Space curve: - A space curve in R^3 is the locus origin 'o' is a function of single parameter t.

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Space curve: - A space curve in R^3 is the locus of a point whose position vector r with respect to the origin 'o' is the function of single parameter t.

We now come to the point to deal the relationships of mathematics with Information Technology (IT), mainly to computer sciences.

Discrete mathematics was born in hoary antiquity. The main feature of "Discrete Mathematics" in discreteness i.e., opposite of Continuity".

Discrete mathematics includes 'number Theory, 'Algebra', 'Mathematical logic and some others develop rapidly. Since the midcentury introduction of computers.

Scientific and technological progress posed the problem of studying complex control systems. Thus, in narrow sense, discrete mathematics is confined only to these new branches.

The new branches of mathematics include the Theory of functional systems graph and Network Theory; coding Theory; Combinatorial Analysis', Integer Programming etc.

Now a day, 'Discrete Mathematics ' is not only the foundation of Cybernetic Theory, but also an important topic in mathematical Education.

The principal task of 'Discrete Mathematics ' is to teach the methods and way of thinking characteristics. In the field of Information Technology mainly in computer sciences, Boolean algebra plays an important role due to its great importance and so in lower section, Boolean algebra is dealt in somewhat details.

2. Literature review

MATHEMATICS is very much older than History. The first mathematician was a Greek named Zeno. Zeno is memorable for proving three theorems: (i) that motion is impossible; (ii) that Achilles can never catch the tortoise (he failed to notice that this follows from his first theorem); and (iii) that half the time may be equal to double the time. This was not considered a very good start by the other Greeks, so they turned their attention to Geometry. Pythagoras (569-500 B.C.) was born on the island of Samos in Greece. Legend has it that upon completion of his famous theorem, Pythagoras sacrificed 100 oxen. Although he is credited with the discovery of the famous theorem, it is not possible to tell if Pythagoras is the actual author [1].

The Pythagoreans had discovered irrational numbers. If we take an isosceles right triangle with legs of measure 1, the hypotenuse will measure. But this number cannot be expressed as a length that can be measured with a ruler divided into fractional parts, and that deeply disturbed the Pythagoreans, who believed that "All is number". They called these numbers "alogon", which means "unutterable". So shocked were the Pythagoreans by these numbers, they put to death a member who dared to mention their existence to the public. It would be 200 years later that the Greek mathematician Eudoxus developed a way to deal with these unutterable numbers [2].

Pythagorean Triple: A Pythagorean triple (like 3-4-5) is a set of three whole numbers that work in the Pythagorean Theorem and can thus be used for the three sides of a right triangle. Euclid, about 300 BC, invented Geometry. The 13 books of the elements describe

geometrical facts about triangle circles and other planar and spatial figures. It is the first axiomatic exposition of mathematics (now-a-days the only approach used). Parallel postulate: Given a line ℓ and a point P not on ℓ, then there exists exactly one line through P that does not meet ℓ. Euclid felt uncomfortable in using this axiom and tried to prove as much as possible without using it [3].

Newton (1643to 1727) was very memorable indeed, chiefly for having just missed living in St. John's. To console himself he invented the Calculus. Newton is also memorable for having been admired by Taylor, who invented Maclaurin's series and admired Newton. However, Taylor lived in St. John's and so was luckier than Newton. The next important mathematician is the Bernoullis. In spite of his having invented numbers, nobody knows how many of him there were, and he lived all over the century [4].

He was called Nicholas, Jacob and John, and one of him was called Daniel. Euler (1707 to 1783), Langrange (1736 to 1813), and Laplace (1749 to 1827) are all famous for inventing equations. Only one of Laplace's equations is well known, but this is enough for anyone. It makes electricity and hydrodynamics much easier for people who don't have to solve it. Euler and Lagrange both went about varying things, which caused the calculus of variations. This was both memorable and regrettable [5].

Lobatchewski (1793 to 1856) must have failed an examination in geometry when he was at school, for he made things harder for everyone by inventing non-Euclidean geometry - just to get his revenge, of course. This was especially bad for the railways, since it made parallel lines so much more difficult [6].

Hamilton (1805 to 1865) was an Irishman. When he had learnt 13 languages before he had left school, he decided that there was no future in this, and looks up mathematics. He invented Hamilton's principle, the Hamiltonian, the Hamilton Jacobi theorem, and the Hamilton-Cayley theorem, but not the Hamilton Academicals. Towards the end of his life he also invented quaternions, but nobody except himself ever fell in love with them [7].

Weierstrass (1815 to 1897) is memorable because of Sonja Kowalewski (1850 to 1891), who, of course, is memorable because of Weierstrass. He said that if you put infinitely many things into a small space, some of them would be pretty close together. The most memorable of all mathematicians was John Couch Adams (1819 to 1890). He had the good fortune to live in St. John's, and was named after this society. He discovered Neptune just after Leverrier, and would have discovered it before if the Astronomer Royal had kept his eyes open [8].

India has a glorious past in the field of mathematics, especially in algebra. There is no doubt that there was a time when the great scholars had adored and those desirous of learning would flock around them for knowledge. Brahmagupta (628 A. D.) gave the following classifications: (i) eka - vargasamikararna- equations in one unknown comprising linear and quadratic equations, (ii) aneka - vargasamikararna- equations in many unknowns, (iii) bhavita - equations involving products of unknown. This classification received further elaboration at the hands of Prthudakasvami (860 A. D.) and Bhaskara - II (1150 A. D.). This primitive method of solving simple linear equations of the type $0 = b + ax$ by substituting guess values a1, a2 etc. in extensive use among the Arab and European mathematicians of the middle ages[9].

3. Vedic Works

It is often believed that Egyptians and Babylonians as being the height of civilisation and of mathematical skills around the period of the Indus civilisation. However, Childe in New Light on the Most Ancient East (1952) wrote. India confronts Egypt and Babylonia by the 3rd millennium with a thoroughly individual and independent civilisation of her own, technically the peer of the rest. And plainly it is deeply rooted in Indian soil. The Indus civilisation represents a very perfect adjustment of human life to a specific environment. And it has endured; it is already specifically Indian and forms the basis of modern Indian culture. In general, when compared with Greek progress in algebra, Hindu works appear to be rather superior.

The Greeks experienced difficulties due to improper symbolism in their number system. This may be mainly due to their immature conception of number. In early works, the Greeks conceived number as spatial extension or length more so than “number” as an abstraction. It seems the lack of sustained development of algebraic ideas may have caused further difficulties such as the Greek failure to solve the in-determinates to such a state as achieved by the Vedic Indians. In summing up the achievements of Indians and Greeks, Singh10 stated that while logic and systematic treatment are outstanding features of Greek geometry, “boldness of conception, abstraction, symbolism and ingenuity are the main features of Indian mathematics”. Moreover, although Arabs must be credited with developing some algebra (cubic based on geometry) later, it is now well

accepted that they were consolidators and transmitters of much of Indian and Greek knowledge rather than the developer or competent user of early symbolic algebra. The older historical authors have indeed changed their views in more recent times; for example, the historian, Eves (1990) stated in his text that Alkwarizmi's work in algebra was not original.

The Vedic Indians had a reasonable knowledge of geometry due to practical calculations needed in their rituals in early Vedic times and much of the knowledge is still evident in the text named Sulba-sutras 800- 500BC. Although the geometry developed during this period appears to be at an empirical and practical level, some of the Indian constructions almost certainly needed much geometrical ingenuity.

Conclusions

In the 21st century, one shifting paradigm in education is about teachers' roles and competencies. Competent math teachers provide a roadmap to guide students to an organized understanding of mathematical concepts, to reflective learning, to critical thinking, and ultimately to mathematical achievement.

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