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Study of Vedic Mathematics and its Multi-Dimensional Application

Dr. Tarannum Siddiqi¹, Dr. Neeti Singh²

¹Assistant Professor, Department of Mathematics, P.P.N. P.G. College, Kanpur.

²Assistant Professor, Department of Mathematics, D.B.S. College, Kanpur.

Abstract

Vedic mathematics is an ancient Indian system of calculation based on sixteen sutras and thirteen sub-sutras with the simple rules and concepts. These sutras are the collection of word equations that explain the steps or reasoning involved in solving a variety of mathematical problems. This paper is an over view of the foundations of Vedic mathematics, such as its origin, history and future aspects. Main object of the paper is to emphasize on the multi-disciplinary applications of Vedic mathematics in today's modern world. Our study is mainly focused on the relevance of our ancient knowledge of calculations in today's fast pacing world. Even nowadays the study of Vedic system of calculations is a most prominent tool for students, professionals, home-makers etc. Everyone is facilitated by the simple and fast verbal calculations with the help of Vedic Mathematics.

Keywords: Veda, Sutra, Ancient, Knowledge, Mathematical operations.

Introduction

The Vedas are religious texts, originated in ancient India, composed in Sanskrit. Vedas are regarded as divine and are believed to be divine relations from God. Veda is a Sanskrit word which means "Knowledge". The content of Vedas was well versed by the Rishi-Muni's in ancient times, in India. By the time, the language of Vedas became too old in later Vedic period. As a result, the Vedangas emerged as an auxiliary in the field of Vedic studies. Vedangas were considered as sciences that help the people to understand and interpret the Vedas, written centuries ago [1].

The Vedangas were divided into six subjects such as phonetics (Siksha), grammar (Vyakrana), etymology and linguistics (Nirukta), poetic meter (Chandas), rituals and rites of passage (Kalpa), time keeping and astronomy (Jyotish). Further, the astronomy or Jyotish Shastra is divided into three Skandas. Skandas means the big branches of a tree

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shooting out of the trunk. Vedic mathematics is a part of these Skandas. Vedic mathematics is a gift of ancient India. It is the system of calculations discovered from ancient Vedic literature [2].

Origin and Development of Vedic Mathematics

The origin of Vedic Mathematics is believed to derive from Vedas which have no certain date and time. But Vedas are considered as the oldest text from the early centuries before Christ [7]. However, Vedic mathematics was initially rediscovered from Indian scriptures between the year 1911 to 1918 by various Rishi-Muni's and their successors and fully developed in 1957 by a learned Indian monk, His Holiness Jagadguru Swami Bharathi Krishna Thirtha Ji Maharaja, the Shankaracharya of Puri.

Father of Vedic Mathematics, Shri Bharathi Krishna spent 8 years in shringari pine forest, practicing Brahma Sadhana and learning Advanced Vedanta Theory. He was a brilliant scholar of Sanskrit, Philosophy, English, Mathematics, History and Science. Having good knowledge of Vedas and Mathematics, Swami Thirtha Ji Maharaja, created sixteen Sutras and thirteen Sub-sutras in Sanskrit. These Sutras were derived from "The Ganita Sutras" also known as "Sulabh Sutras" or simple system of Mathematics. The Sutras collectively were later named as Vedic mathematics. Swami ji passed away in 1960 and his disciples first time published his work in the form of a book titled "Vedic Mathematics: Sixteen Simple Mathematical Formulae from the Vedas" in 1965. After that, it was reprinted fifteen times. The book is considered to be the oldest on this subject [8].

Sutras and Sub-Sutras of Vedic Mathematics

Among the many mathematical contributions, vedic mathematics stands out as a unique collection of efficient techniques for solving mathematical arithmetic, this system consists of sixteen sutras or principles and thirteen sub-sutras, each being a word formula capable of solving a broad spectrum of mathematical problems [11].

The inception of this remarkable technique not only provides mathematical solutions with simplicity and speed but also adding a fresh dimension to the discipline and reflecting the ingenious sprit of India.

Sutras

- 1. Ekadhikena Purvena (One more than the previous one):** This sutra is useful for cases where the number is close to the base, like 10, 100, 1000, etc. It is mainly used in finding squares of numbers near these bases.
- 2. Nikhilam Navatashcaramam Dashatah (All from 9 and the last from 10):** This sutra is helpful when you are subtracting a number from a large round number like 10, 100, 1000, etc.
- 3. Urdhva-Tiryakbhyam (Vertically and crosswise):** This sutra is useful for multiplication of numbers where the multipliers are more than the number 10. It can also be applied for the multiplication of numbers close to bases (10, 100, 1000, etc).

4. **Paravartya Yojayet (Transpose and adjust):** This sutra is used in division. It makes any type of division simple.
5. **Shunyam Saamyasamuccaye (When the sum is the same that sum is zero):** This sutra is used in solving simultaneous linear equations where the coefficients of the variables are the same. The sum (or, difference) of the coefficients in the variables of these equations is zero.
6. **Anurupye - Sunyamanyat (If one is in ratio, the other one is zero):** Used in solving simultaneous linear equations, this sutra comes into play when the coefficients of one variable are in the same ratio to each other as the independent terms.
7. **Sankalana-vyavakalanabhyam (By addition and by subtraction):** This sutra is used to solve a special type of simultaneous linear equations where the coefficients of 'x' and 'y' are interchanged.
8. **Purana Puranabhyam (By the completion or non-completion):** When the given data is incomplete, this method helps us to find the complete data first and then solve the problem.
9. **Chalana-Kalanabhyam (Differences and Similarities):** This sutra is mainly used for solving the problems where differentiation is involved.
10. **Yaavadunam (As much as the extend):** This sutra is useful in the operations involving '0'. It helps in case of multiplication.
11. **Vyashtisamanstih (Part and Whole):** This is applied to find the product of two numbers when one number is far away from the base. It is also useful in solving complex numbers and statistics.
12. **Shesanyankena Charamena (The remainders by the last digit):** This one helps in finding the remainders of division problems. It's used when we divide a number by 9.
13. **Sopaantyadvayamantyam (The ultimate and twice the penultimate):** Applicable when the multiplication of numbers whose last digits together make 10 and the remaining digits are identical.
14. **Ekanyunena Purvena (One less than the previous one):** This sutra is used for the multiplication of numbers whose last digits add up to 10 and the preceding numbers are the same.
15. **Ganitasamuccayah (The product of the sum is equal to the sum of the product):** Problems related to algebra and geometry.
16. **Gunakasamuchyah (The factor of the sum is the sum of the factor):** This sutra can be applied in factorization and solving algebraic equations.

Sub-Sutras

1. **Anurupyena** (Proportionately)
2. **Sityate Sesasanfitah** (The remainder remains constant)
3. **Adyamadyenantyainantyena** (The first by the first and last by the last)
4. **Kevalal Saptakan Gunyat** (In case of 7 our multiplicand should be 143)
5. **Vestanam** (By osculation)

6. **Yavadunam Tavadunam** (Lessen by the Deficiency)
7. **Yavadunam Taradunikrtya Varganca Yojayet** (Whatever the extent of its deficiency, lessen it still to that very extent; and also set up the square of that deficiency)
8. **Antyayordasake'pt** (Whose last digits together total 10 and whose previous part is exactly the same)
9. **Antyayoteva** (Only the last terms)
10. **Samuccayaguaitah** (The some of the coefficients in the product)
11. **Lopasthapanambhyam** (By alternate elimination and retention)
12. **Vilokanam** (By observation)
13. **Gunitasamuccayah Samuccayagunitah** (The product of sum of the coefficients in the factors is equal to the sum of the coefficients in the product)

Review of Previous Studies

Vedic Mathematics is primarily a collection of methods, called the Sutras that aim at making numerical computation, faster and easier [6]. It is an ancient mathematical technique based on sixteen Vedic sutras (formulae), which are a collection of word equations that explain the steps or reasoning involved in solving a variety of mathematical problems that are difficult and time consuming. Each formula describes a mental working concept that may be utilized to execute a variety of mathematical operations like as addition, subtraction, division and multiplication, square roots, cube roots etc. to any trigonometric, algebraic, arithmetic and geometric problems with a rapid speed and accuracy. Vedic mathematics is a basic mathematics, but a better method to perform difficult calculations in no time [4].

Practice of Vedic mathematics also improve logical and decision making ability with faster verbal calculations. This fact is studied and proved mathematically with the help of several statistical formulae in difference research papers. A considerable number of studies have been conducted on Vedic Mathematics and consequences out of these studies are surprisingly amazing. Various researches have proven that Vedic Mathematics is not only plays its role in numerical computation but also develops and enhances analytical thinking capabilities, reasoning power and logical abilities [5].

It was found that Vedic Mathematics algorithms lead to faster mental calculations and high speed Arithmetic architectures can be derived from Vedic Mathematics. From the study, on improving computational skill using Vedic Mathematics, it was found that using Vedic Mathematical techniques student's accuracy on calculations became considerably elevated and consumption of time was also reduced remarkably [9].

Studies show that Vedic Mathematics is very effective in student's achievement in mathematics as compared to the traditional talk and chalk method. As extensive exposure of Vedic mathematics can definitely create interest in the subject among the children in primary level and help to reduce the fear towards mathematics. Vedic Mathematics is found to be more effective in solving multiplication problems in schools rather than the traditional techniques [3].

Features of Vedic Mathematics Beneficial to All

A considerable number of studies have been conducted on Vedic Mathematics and many pieces of literature are also available on the topic but still there is a need to explore Vedic Mathematics at every level of our education system as well as in various fields of our society. In this paper we have explored how Vedic Mathematics is helpful for everyone and emphasis is given to produce a brief account of its applications in various fields in the present time.

Vedic Mathematics is a system of mathematics that originated in ancient India but still relevant due to its unique approach to mathematics that uses simple and efficient methods to solve complex problems. The application of Vedic Mathematics in modern education can have several benefits, including:

Speed and accuracy: Vedic Mathematics provides students with quick and accurate methods to solve mathematical problems. It can help student save time and improve their accuracy in solving problems.

Mental Calculation: Vedic Mathematics emphasizes mental calculation, which can help students develop their cognitive skill and improve their memory.

Problem-Solving Skills: Vedic mathematics encourages students to think creatively while solving the problems. It can help students to develop problem-solving skills that can be applied in other areas of their lives.

Increased Confidence: Vedic Mathematics can help students build confidence in their mathematical abilities. It can help students overcome their fear of math and develop a positive attitude towards the subject.

Improved Learning Experience: Vedic Mathematics provides a fun and engaging learning experience for students. It can help students enjoy learning mathematics and develop a lifelong interest for the subject.

Applications of Vedic Mathematics

The application of Vedic Mathematics in modern education can have several benefits for students. It can help students improve their speed and accuracy, develop the mental calculation skills, improve problem-solving skills, increase confidence and provide an enjoyable learning experience. All these features of Vedic Mathematics make it useful for the students. Therefore Vedic Mathematics finds the most prominent place in our education system. From primary school to university level it should be a part of the curriculum.

Application in Education System at School Level

In our educational system, achievement tests are the key to measure the progress of students. Especially at the school level, power tests are used in which the students are directed to answer the questions within a specific time limit. Therefore, time plays an important role in any examination and if time can be saved in calculation, it may be used to solve other

problems. Most of the students fail to solve the problem not due to ignorance but due to shortage of time and due to wrong calculations done in haste.

Even in higher education level nowadays, especially after the pandemic period, online examinations are being conducted in which only multiple choice questions are usually asked and the students are required to perform swiftly and accurately.

Application in Higher Education

Vedic mathematics is not only helpful in school children, Higher Secondary and senior secondary level but also plays a prominent role in various branches of Higher education system.

Vedic math covers every nook and corner of mathematics, starting from arithmetic operation, geometry, trigonometry, calculus, differential and integral calculus, algebra, differential equations, Fourier analysis, differential and computational geometry, probability and statics, numerical analysis, operation research and optimization, computer architecture, astronomy, numerology and many more. Almost every aspect of life is connected with Vedic mathematics and its simple calculation technique.

Beneficial for Students Persuing Competitive Exams

This is because Vedic mathematics involves special algorithms and techniques that allow for quick verbal calculations. This quality of Vedic math makes it ideal for professionals and students persuing competitive exams where they need to solve the problems in less time. Vedic mathematics has many tricks to perform different mathematical operations in very little time as compared to normal procedures. It also enhanced one's decision making capabilities, reasoning and rational thinking. Therefore it increases the chance of success of any student or professional to crack these examinations with high scores.

Application in Professional Study Programmes

Apart from higher education, Vedic mathematics can also be applied in various fields of researches, including the professional study programmes such as:

Science and Engineering: Vedic mathematics can be used to solve complex calculations in science and engineering fields. It can help scientists and engineers save time and improve accuracy in their calculations.

Finance and Accounting: Vedic mathematics can be used in finance and accounting to calculate interest rates, discounts and other financial calculations quickly and accurately.

Computer Science: Vedic mathematics can be applied in computer science to optimize algorithms and improve computational efficiency.

Business Management: Vedic mathematics can be used in business management to analyze data, forecast trends and make strategic decisions.

The application of Vedic mathematics is not limited to education but can be applied in various fields to improve efficiency and accuracy in calculations.

Application of Vedic Mathematics in Modern World

This is the era of digitalization. Engineers are working on increasing the speed of digital circuits which reducing the size and power consumption and hence optimizing the efficiency of entire digital design (Arithmetic operations are the basic units of all digital networks and circuits). Unlike conventional mathematics, Vedic mathematics provides different techniques to compute basic arithmetic operations. Vedic mathematics reduces the computational steps to achieve the required results. Designers have implemented many computer architectures based on Vedic Mathematics [10].

It facilitates Telecommunication, Transport, Construction, Banking, Internet Entertainment, Graphics, Medical development, Marketing, Astrology, Numerology, Space Science and Robotics etc. Each and every machine we can think of starting from a simple wrist watch to a computer, or rocket, or a satellite all are base upon the mathematical computations. No machine or no work can be completed without using some basic mathematical calculations. All these calculations are based upon the Vedic mathematics which is a gift from Vedas of ancient India to the world.

Even today Vedas are the everlasting source of knowledge and showing path to the modern world. Vedic Mathematics is believed to be derived from Vedas, especially from Atharva Veda which deals with technology, Engineering and Sciences we use in our daily life.

Application of Vedic Mathematics in our Daily Life

It helps a person to perform simple day to day calculations many times faster, if we use the sutras of Vedic mathematics. It also helps in making decisions more intelligently. It reduces the stress of understanding difficult concepts as it promotes mental calculation at ease. Vedic mathematics give a better understanding of mathematics as well as increases creativity and confidence. Vedic Mathematics supports us in managing and performing daily life tasks, successfully. Some of them are as follows:-

- Managing Money and Banking
- Shopping for the best price
- Preparing food also requires measurement of ingredients and time for cooking
- Figuring out distance, time and cost for travel
- Understanding loans for home, cars etc.
- Understanding sports
- Planning for any big or small event
- Running business

Planning, execution and successfully achieving our goals, every step of our life requires more or less some basic calculations. Mathematics touches our lives from the second of our birth

till death. Even the number of breath we take can be calculated only with the help of some basis calculations.

Conclusions

By practicing Vedic Mathematics, mathematics can be learned as an enjoyable subject. It is a mental tool for calculation that encourages the development and innovation, while giving the students a lot of flexibility, fun and satisfaction. Vedic Mathematics helps in speed and accuracy in solving numerical problems, prepares school children to overcome that fear of mathematics. Vedic Mathematics is helpful to each and every person whether he is a student, a professional, a scientist or a common-man. As it creates artistic qualities, flexibility in thoughts, increases mental efficiency and abilities and promotes creativity. Therefore, Vedic Mathematics appeals everyone. It also increases the spirituality in personality. So, we can state that Vedic Mathematics is a divine gift for all.

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