



Relevancy of Vedic Mathematics in Pedagogy

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Abstract

The genesis of vedic mathematics is emanating from 16 sutras (Formulae) and 13 sub-sutras (Sub Formulae), rediscovered from Vedas by Sri Bharati Krishna Tirthaji (1884-1960) between 1911 and 1918. Such fundamental sutras have been propounded by Bhaskaracharya in his famous book "Lilawati". Ancient India has provided to the world atypical contribution through Vedic Mathematics, especially to the world of mathematicians-often named as "tricks" or "mental maths" by the western people-which, remains an oldest and the fastest method for computations from time immemorial. The ever prevailing and comprehensive use of vedic mathematics is a well-known veracity and universal truth enthusiastically praised by ancient mathematicians, philosophers, saint and seers of ancient India. The basic idea behind it is to get maximum output from minimum efforts. The ubiquitous utility of Vedic mathematics has been found relevant even in the common field of information technology and telecommunication of NASA laboratories. My research paper underlines vital role of the said mathematics/sutras to enhance and sharpen mental ability and agility of scholars and students which can be supportive in competitive exams like CAT, JEE, NTSE, CET, Banking exams etc. thus making our younger generation more innovative and creative.

Keywords: Vedic mathematics, sutras and sub sutras, utility, innovative, creative, mental ability, information technology

Introduction

The beauty of Mathematics is omnipresent in the universe. It is used in every walk of life, to purchase ration or vegetable, success of Chandrayan or formula to fight with Corona virus etc. A Polish Mathematician Stelan Banach said, "Mathematics is the most beautiful and the most powerful creation of the Human spirit". It is a great motivator for all human beings because it starts from zero and never ends (infinity). In spite of this significance, this subject is boring and burdensome for many people. Now the question arises how to make the subject interesting? Vedic mathematics provides an innovative way of mathematical calculations and may be supportive to make the subject interesting.

Aforesaid subject is an ancient system of mathematics composed of sixteen sutras and some sub-sutras. It originated in India and can be searched in the Sthapatya Veda, an Upveda of Atharva Veda. Above said subject was rediscovered from Vedas by Sri Bharati Krishna Tirthaji (1884-1960) between 1911 and 1918. Swami Bharati Krishna Tirthaji who was also the former Shankaracharya of Puri (India), was a great scholar who structured mathematics into sutra traditions of Indian mathematics by dint of deep study and careful research. Vedic Mathematics (1965), an innovative work of Bharati Krishna Tirthaji containing techniques of Vedic mathematics is considered as the initial point for all work towards Vedic Mathematics. It is said that after having lost his original sixteen volumes of work on vedic system in final years, he authored this single volume.

An ancient India has given an exclusive share to the universe through Vedic Mathematics especially to the world of mathematicians-often connoted as "tricks" or "mental maths" by the western people-which remains the oldest and the fastest method for computations from time immemorial. The ever prevailing and comprehensive use of Vedic mathematics is a well-known veracity and universal truth enthusiastically praised by ancient mathematicians, philosophers, saint and seers of ancient India. The idea behind it is to get maximum output from minimum effort. My research paper underlines the vital role of vedic mathematics/sutras to enhance and sharpen mental ability and agility of scholars and students. World is looking towards India due to our rich culture. India has been a land of Rishis (saints) since time immemorial who has given a great contribution to the world in the field of Yoga, Ayurveda and vedic maths. India has emerged as Vishv-Guru as happened in against Corona virus fight. Even the Most powerful country (America) has followed our Prime Minister. Whole world has adopted our "NAMESTA" culture that includes scientific logic. India has originated a world renowned university Takshashila.

When a copy of the book on Vedic mathematics was received in London in the late 1960s, it was enthusiastically praised as a new system of mathematics. Some of British mathematicians, like Kenneth Williams, Andrew Nicholas and Jeremy Pickles, began to draw attention in this new system. The introductory content of Bharati Krishna's book was elaborated by them and lectures were delivered on it in

London. In 1981, all these proceedings were assembled into a book having the title "Introductory Lectures on Vedic Mathematics". Andrew Nicholas revitalized Vedic mathematics after having some visits in India between 1981 and 1987, after that researchers and learners in India started to take it deeply interested. Mahesh Yogi said that the sutras of Vedic Mathematics are the software for the cosmic computer that runs this world. Many Indian mathematicians have included their names in the list of big contributors afore, across the globe like Aryabhata (provided the significance of zero) and so on. They discovered vedic mathematics that has been referred in Hindu Vedas. The sutras of the forenamed subject can be applied for computation of complicated mathematical problems. Shri Bharati Krishna Tirthaji told in a talk at the institute of Technology, Pasadena, California, U.S.A. in 1958 that persons who have practical knowledge of the application of the sutras, need not study theoretical portion of the content. This feature distinguishes between those people who want to study the subject by doing practice of Sutras only and those who gain knowledge by learning theory as well as practice of these Sutras. A lot of study has been done to know how to develop more powerful and easy utility of the Vedic *sutras* in geometry, calculus and computing. Kapoor, S.K (2003) ^[7] explains glimpses of Vedic mathematics in his book. Purushottam D. Chidgupkar and Mangesh T. Karad (2004) ^[9] highlighted the growing need for faster calculation techniques in the field of digital signal processing (D.S.P.) in his article, the Implementation of Vedic Algorithms in Digital Signal Processing. Thapliyal H. and Srinivas M.B. (2005) ^[3] examined VLSI implementation of RSA Encryption system using Vedic Mathematics. Hanumantharaju M.C *et al.* (2007) ^[4] studied high speed block convolution using ancient Indian Vedic Mathematics. Ghisha Ram Meena (2011) ^[2] explained fundamental Principles of Vedic Mathematics. Bhardwaj, S. *et al.* (2012) ^[1] described a novel approach for optimization in mathematical calculations using vedic mathematics techniques. Prasad K. K (2016), made an empirical study on role of vedic mathematics in improving the speed of basic mathematical operations. Subsequently, I tried to make efforts to study this topic of Vedic Mathematics.

Objective of Study: To create awareness towards computations using Vedic mathematics keeping our Indian heritage alive. To examine its usage in competitive exams for our young aspirants and its utility in various fields.

Methodology: I carefully made study of aforesaid subject, its significance. An extensive study of review of literature was performed for its applicability in various fields by usage of vedic sutras.

16 Sutras of Vedic Mathematics: These are main sixteen sutras of our ancient Indian Mathematics.

- i). Ekadhikena Purvena
- ii). Nikhilam Navatashcaramam Dashatah
- iii). Urdhva-Tiryagbyham
- iv). ParavartyaYojayet
- v). Shunyam Samyasamuccaye.
- vi). (Anurupya) Sunyamanyat
- vii). Sankalana-Vyavakalanabhyam
- viii). Puranapurabhyam
- ix). Calana Kalanabhyam
- x). Yavadunam
- xi). Vyastisamastih
- xii). Sesanyakena Caramena
- xiii). Sopantyadvayamantyam
- xiv). Ekanyunena Purvena

xv). Gunitsamuccayah

xvi). Gunakasamuchyah

(Source of sutras: Dr. S.K. Kapoor: glimpses of vedic mathematics, 2003) ^[7]

The Sub-Sutras: The list of sixteen sutras contains some sub-sutras also. For example: Proportionately, by alternate elimination and retention, etc

Characteristics of the Aforesaid Subject: To make complex to simple is the quality of a true scientist that is taught by vedic mathematics. The benefits accruing from the Vedic Mathematics are as follows:

- It is many times faster than conventional maths.
- Sharpens the mind, increases mental agility and intelligence.
- Fosters an interest in maths and removes maths-phobia.
- It is supportive in intelligent guessing (knowing the answer without actually solving the problem).
- It increases concentration, enhances logical thinking process and develops confidence especially among children.
- Enhancing speed and accuracy, time is saved during examination. While cross checking answers, it can be helpful to rectify mistakes.

Using Vedic Maths Tricks one can find products in mind in a few seconds. For example: Urdhva-tiryakby (vertically and cross wise) Sutra. This sutra can facilitate all types of products. It is simpler and easier method than conventional mathematics to perform products of large numbers.

Let us proceed further from simple question to some complex questions of multiplication by Nikhilam and Urdhva-tiryakbyham sutra.

Multiply: 45 x 11

$$\begin{array}{r} \text{Step 1} \quad 4 \quad 5 \\ \downarrow \quad \downarrow \\ 4 \quad 5 \end{array}$$

Ans. 495

Similarly $75 \times 11 = 7 \downarrow 25 = 825$

Base 10

Simplify: 9 x 8

$$\begin{array}{r} 9 \quad -1 \\ \times 8 \quad -2 \\ \hline 7 \quad / \quad 2 \end{array}$$

(i) 9 is 1 less than 10 and 8 is 2 less than 10
(ii) $-1 \times -2 = 2$ and either $9-2$ or $8-1$

Ans. 72

Multiply: 15 x 13

$$\begin{array}{r} 15 \quad +5 \\ \times 13 \quad +3 \\ \hline 18 \quad / \quad 15 \end{array}$$

(i) 15 is more than 10 and 13 is 3 more than 10
(ii) $+5 \times 3 = 15$ and either $15+3$ or $13+5$

Ans. $18/15 = 18/15 = 195$

Base 100

Multiply: 97x96

$$\begin{array}{r} 97 \quad -03 \\ \times 96 \quad -04 \\ \hline 93 \quad / \quad 12 \end{array}$$

(1) 97 is 3 less than 100 and 96 is 4 less than 100
(2) Multiply -03×-04 and either $97-04$ or $96-03$

Ans. 9312

(Base 1000)

$$\begin{array}{r} 998 \\ \times 997 \\ \hline 995 \quad / \quad 006 \end{array}$$

(1) 998 is 2 less than 1000 and 997 is 3 less than 1000
(2) Multiply -002x-003 and either 998-003 or 997-002

Ans. 995006

Simplify: 105^2

$$\begin{array}{r} 105 \\ \times 105 \\ \hline 110 \quad / \quad 25 \end{array}$$

Ans. 11025

Simplify: $93 \times 96 \times 98$

$$\begin{aligned} 93 \times 96 \times 98 &= 93-4-2 / (-7) \times (-4) + (-4) \times (-2) + (-2) \times (-7) \\ &= 87 / 28+8+14 / -56 = 87 / 50 / -56 \\ &= 87 / 50-1 / 100-56 = 87 / 49 / 44 \\ &= 874944 \end{aligned}$$

Simplify: $108 \times 106 \times 105$

$$\begin{aligned} 108 \times 106 \times 105 &= 108+6+5 / 8 \times 6+6 \times 5+5 \times 8 / 8 \times 6 \times 5 \\ &= 119 / 48+30+40 / 240 \\ &= 119 / 118 / 240 = 119 / 118 / 240 \\ &= 1202040 \end{aligned}$$

Urdhva-tiryakbyham (Vertically and Crosswise)

Multiply: 31×12

$$\begin{array}{r} 3 \quad 1 \\ \uparrow \quad \uparrow \\ 1 \quad 2 \end{array} \quad 1 \times 2 = 2$$

$$\begin{array}{r} 3 \quad 1 \\ \nearrow \quad \nwarrow \\ 1 \quad 2 \end{array} \quad 1 \times 1 + 2 \times 3 = 7$$

$$\begin{array}{r} 3 \quad 1 \\ \uparrow \quad \uparrow \\ 1 \quad 2 \end{array} \quad 3 \times 1 = 3$$

$$\begin{array}{r} 3 \quad 1 \\ \nearrow \quad \nwarrow \quad \uparrow \\ 1 \quad 2 \end{array}$$

Ans. 372

Simplify: 12×34

$$\begin{array}{r} 1 \quad 2 \\ \nearrow \quad \nwarrow \\ 3 \quad 4 \\ \hline 4 \quad 0 \quad 8 \end{array} \quad 4 \times 1 + 3 \times 2 = 10, \quad 1\text{-Carry}$$

Simplify: 653×423

$$\begin{array}{r} 6 \quad 5 \quad 3 \\ \uparrow \quad \nearrow \quad \nwarrow \quad \uparrow \\ 4 \quad 2 \quad 3 \end{array} \quad \begin{array}{r} 6 \quad 5 \quad 3 \\ \nearrow \quad \nwarrow \quad \uparrow \\ 4 \quad 2 \quad 3 \end{array} \quad \begin{array}{r} 5 \quad 3 \\ \nearrow \quad \nwarrow \\ 2 \quad 3 \end{array} \quad \begin{array}{r} 3 \\ \uparrow \\ 3 \end{array}$$

$$\begin{aligned} &= 6 \times 4 / 6 \times 2 + 4 \times 5 / 6 \times 3 + 4 \times 3 + 5 \times 2 / 5 \times 3 + 2 \times 3 / 3 \\ &= 24 / 12 + 20 / 18 + 12 + 10 / 15 + 6 / 9 = 24 / 32 / 40 / 21 / 9 \end{aligned}$$

$$= 24 / 32 / 40 / 21 / 9$$

$$= 276219$$

Calculate 2352^2

$$\begin{array}{r} 2 \quad 23 \quad 235 \quad 352 \quad 52 \quad 2 \\ 2 \quad 23 \quad 235 \quad 352 \quad 52 \quad 2 \end{array}$$

1. Calculate D of 2 (1^{st} digit) $= 2^2 = 4$
2. Calculate D of 23 $= 2 \times (2 \times 3) = 12$
3. Calculate D of 235 $= 2 \times (2 \times 5) + 3^2 = 20 + 9 = 29$
4. Calculate D of 2352 $= 2 \times (2 \times 2) + 2 \times (3 \times 5) = 8 + 30 = 38$
5. Calculate D of 352 $= 2 \times (3 \times 2) + 5^2 = 12 + 25 = 37$
6. Calculate D of 52 $= 2 \times (5 \times 2) = 20$
7. Calculate D of 2 $= 2 \times 2 = 4$

$$\text{Hence } 2352^2 = 4 / 12 / 29 / 38 / 37 / 20 / 4 = 4 / 12 / 29 / 38 / 37 / 20 / 4 = 5531904$$

Example by using EKĀDHIKENAPŪRVEṆA (by one more than the previous one)

Have a number whose unit's digit is 5. For example 35^2 .

We have to solve the square of 35 whose last digit is 5 and the 'previous' digit is 3. Now, one more than the previous one, i.e. $3+1=4$. The Sutra, in this, gives the procedure 'to multiply the previous digit 3 by one more than itself, i.e.

$3 \times 4 = 12$. And 5^2 , i.e. $5 \times 5 = 25$.

Hence the required answer: $35^2 = 3 \times 4 / 25 = 12 / 25 = 1225$

Application of Vedic Mathematics

The formulas of Vedic Maths can be applicable in diverse fields. Let us have a glance where the Vedic Maths formulas are applied.

Education: The usage of Vedic Math is prevalently observed in the education area. The utility of Vedic maths has far-reaching effect for grade-III onwards up to competitive exam aspirants. Vedic maths techniques/Sutras are very supportive for students preparing for entrance exams/competitive exams like CAT, JEE, NTSE, CET, Banking exams etc because it enhances mental calculation abilities and calculating much faster as compared to conventional methods.

Information Technology: The usefulness of Vedic mathematics is ingrained in the concept that it removes cumbersome calculations in traditional mathematics and converts them to simpler form. The human mind acts on natural principals and that is basis of vedic formulae. Modern computer-savvy scholars make use of Vedic Maths as a useful tool. Many researchers apply V.M. in the field of digital signal processing, by increasing the multiplicative speed of the Digital Signal Processor, the overall speed of the computer is increased. The third sutra of aforesaid Mathematics i.e. Urdhva Tiryakbhyam (vertically and crosswise), is basis of the installed multiplier. Even foreign researchers are implementing this ancient technique to process the algorithm fastly. In this modern era of digitization, Engineers make use of these sutras in various concepts like chip designing, RSA encryption system etc. by usage of computations like division, product, addition, subtraction squares and so on..

The usage of the aforesaid mathematics can facilitate to enhance speed, to lower power utilization and other complicity during examination. To produce fruitful results in de-noising of bio medical signal in FIR and IIR filters, algorithm based on above mentioned maths can be found more efficacious. Even the scientist named Dr. Rick

Briggs applied Vedic Mathematics in NASA, an American Research Centre for Space technology.

Now, an open ended question is; when we have a marvellous and facilitating method of performing complicated calculations, then it must be taught in all the schools, from the pre-nursery onwards. It is better to inculcate a good habit in the childhood. Swami Vivekanand Ji used to say that as you think. so shall you do and then become alike that. We still believe in design of western education. People must take initiative towards aforesaid mathematics. However some states have introduced it as a part of their curriculum.

Conclusion

Anyone who has some interest in knowledge of vedic mathematics will observe that it is really more integrated, efficacious and funny than traditional mathematics. It enhances flexibility of mind, mental agility and boosts the creativity of the students. But one can get expertise in this field by practice and enthusiasm only. Engineers, scientists and scholars can get benefit from the forenamed sutras. India is repository of talented brains which has brought laurels to the Nation. In this cut through competition, dissemination of knowledge towards Vedic maths and revive our Indian system is need of the day. More and more efforts are required to implement, to boost the Indian system towards V.M. However some of the universities have introduced vedic mathematics in curriculum such as Indira Gandhi University, Meerpur (Rewari), Haryana has introduced this subject in syllabus. All the prominent universities may begin befitting research centres for boosting research works in aforementioned area to survive our ancient Indian heritage. The programme "Digital India, Skill India" launched by Our Prime Minister Narendra Modi Ji may also gain momentum by using our rich heritage, reaching from earth to moon and mars thus making our younger generation more innovative and creative.

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