ROLE OF VEDIC MATHEMATICS IN DRIVING OPTIMAL SOLUTIONS FOR REAL LIFE PROBLEMS

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ABSTRACT:

"Veda" by means of "Store house of knowledge". Vedic Mathematics has 16 sutras and 15 sub-sutras or word formulae. These sutras are in words and very much useful in solving the problems. These sutras here able to find that Vedic method significantly the "Role of Vedic Mathematics in driving optimal solutions for real life problems. Vedic Mathematics is not only useful for arithmetic computations but also helpful for solving problems related to other branches of Mathematics as Algebra, Trigonometry, Geometry and Calculus etc. Vedic Mathematics are highly efficient when it comes to regular arithmetic like subtraction, division, multiplication, additions, squares, square roots, cubes, cube roots, partial fractions, derivatives, decimals, solving equations etc., and conversions like temperature, distance, kilos to pounds, kilometers to meters etc. Vedic Mathematics not only helps in faster computations but also in determining the right solutions to a problem.

Key words: Vedic Mathematics, Trigonometry, Geometry, temperature, distance.

Introduction to Vedic Mathematics:

The "Vedic Mathematics" is called so because of its origin from Vedas. To be more specific it has originated from "Atharva Veda" the fourth Veda. "Atharva Veda" deals with branches like Engineering, Mathematics, Sculpture, medicine, and all other sciences with we are today aware of.

The Sanskrit word Veda is derived from the root Vid, meaning to know without limit. The word Veda covers all Veda–Sakhas know to humanity. The Veda is a repository of all Knowledge, Fathomless, ever revealing as it is delved deeper. Knowledge, Fathomless, ever revealing as it is delved deeper. Vedic Mathematics, which simplifies arithmetic and algebraic operations, has increasingly found acceptance the world over. Experts suggest that it could be a handy tool for those who need to solve mathematical problems faster by the day. It is an ancient technique, which simplifies multiplication, divisibility, complex numbers, squaring, cubing, square roots and cube roots. Even recurring decimals and auxiliary fractions can be handled by Vedic mathematics. Vedic Mathematics

forms part of Jyotish Shastra which is one of the six parts of Vedangas. The Jyotish Shastra or Astronomy is made up of three parts called Skandas. A Skanda means the big branch of a tree shooting out of the trunk.

Benefits of Vedic Mathematics:

- It helps a person to solve mathematical problems 10-15 times faster.
- It creates interest towards mathematics.
- It will be beneficial throughout lifetime.
- It helps in Intelligent Guessing (Knowing the answer without actually solving the problem)
- It is a magical tool to reduce scratch work and finger counting and improve Mental Calculation.
- It increases concentration.
- It improves confidence.
- It reduces burden (Need to learn tables up to nine only).
- The development of creativity at a young age is helpful towards understandingadvanced concepts.
- It can be applied even for numbers beyond 10 digits.
- Saves time during Examination.

Literature on Vedic Mathematics:

While searching for evidence based information about Vedic Math, one thing became clear quickly, very little empirical information exists at all. The original book on this subject Authored by Sri Bharati Krishna Tirthaji was originally published in 1965 and is the foundation For all other books on the subject. The editor's note at the beginning discusses the source of The author's inspiration. He was considered "one of die-hard believers who think that the Vedas represent an inexhaustible mine of wisdom in matters both spiritual and temporal." of the sixteen volumes developed by the author, only this one survived to be published. The difficulty the reader may have in letting go of conventional methods is also discussed.

The actual descriptions of the math used seem more difficult to understand than in other texts read on the subject. This work represents the beginning of the Vedic method and the controversy that exists around its origins. While devout believers insist that he studied Vedic principles with such conviction that he was able to unravel and reveal the hidden mathematical truths (sutras) that existed within them, others contend that he was merely a mathematical genius who formulated the principles himself as the Vedas do not contain mathematical references. All resources about Vedic Mathematics divide sharply on either side of this fault line. In either case, Vedic Mathematics is an example of how tightly connected mathematics is to culture. Regardless of the controversy of origin, the opportunity for this method to assist learners is worthy of exploration.

Need and importance of Vedic Mathematics:

Mathematics is one of the most important & compulsory subject in our school curriculum. From Multi millionaires to daily laborers have been using mathematics in one or another way. Therefore everyone should have the knowledge of mathematics. But today most of our younger generations are completely depending upon technology. Technology has been diminishing their creativity. Because of many barriers, they cannot depend upon technology. They should know Vedic Mathematics to solve mathematics problem very easily & quickly. It is the duty of teachers

to preserve our traditions as well as lead our students to be self-dependent & solve the mathematics problems confidently. Today, many schools and even universities use Vedic Mathematics as an alternative system of mathematics in modern mathematics. Modern mathematics has established methods and allows the use of calculators. In the case of Vedic math, it is flexible and encourages the use of arithmetic, geometry & trigonometry. This may contribute to brain development in children. However, much research is still ongoing, especially in India to find ways to facilitate the application of Vedic mathematics in Calculus, Geometry and Trigonometry.

Applications of Vedic Mathematics:

It is important to understand that (theoritically) the Vedic Mathematical Sutras and Upasutras were developed to mentally execute cumbrous calculations for practical usage. Thus, they mostly deal with special cases (like a number ending with 5, or a number close to a power of 10) based on the demand of usage in the time-period that they were developed, and for practical need for measurements to aid architectural constructions, and trading. This formulae, than some of the Sutras. Nevertheless, the generic methods were overshadowed as corollaries, by specific rules which are case dependent, but in tune with the need of the time-period that they were developed in. This section explains the application of Vedic Mathematics in the context of current mathematical expectations. Accordingly, all rules within the Vedic Mathematical structure is considered under a common umbrella of 'Principles of Vedic Mathematics' – irrespective of them being a Sutra or an Upasutra. Our unbiased observations in applying the principles Vedic Mathematics are as follows:

The principles that overshadow and outshine conventional methods, and even the rest of Vedic Mathematics are:

- **Suddha(Purification):** This is the primary and standard from of Vedic Mathematics that involves addition and subtraction of two numbers: X and Y ; where X and Y are variables. The addition takes place by using the traditional method based on the place values: **Example:**

Modern Mathematics	Vedic Mathematics
$X = 29, Y = 42$ $X + Y$ 29 +42 _____ 71	$X = 29, Y = 42$ $X + Y$ 2 9 +4 2 _____ 6 11 Since each place values should have one digit in them the extra digit is added to next number. Thus by suddhikaran, (6,11) = 71 is the answer

Vedic Mathematics Sutras:

This is a simplified and summarized version of Vedic Maths – a book written by the Indian Hindu Priest Bharati Krishna Tirthaji and first published in 1965. The Vedic Maths contains 16 sutras (formulae) and 13 sub-sutras. These Sutras cover almost every branch of Mathematics. They apply even to complex problems involving a large number of mathematical operations. Application of the Sutras saves a lot of time and effort in solving the problems, compared to the formal methods presently in vogue. Though the solutions appear like magic, the application of the Sutras is perfectly logical and rational. The Sutras provide not only methods of calculation, but also ways of thinking for their application.

The Sutras:

The sixteen sutras and their meaning and uses are:

Name/Sutra	Meaning	Where to use
1.Ekadhikena Purvena	By one more than the previous one	Squaring of a number ending with 5
2.Nikhilam-Navatashcaramam Dashatah	All from 9 and the last from 10	Multiplication of numbers, which are near to base like 10, 100, 1000
3.Urdhva-Tiryagbyham	Vertically and crosswise	It is the general formula, applicable to all cases of multiplication of two large number
4.Paravartya Yojayet	Transpose and adjust	When divisor greater than 10
5.Shunyam Saamyasamuccaye	When the sum is the same that sum is zero	To find the value of 'x' in an linear equation
6.Anurupye Shunyamanyat	If one is in ratio, the other is zero	To find out the product of two number when both are near the
15. Gunitasamuchyah	The product of the sum is equal to the sum of the product	Used to verify the correctness of obtained answers in multiplications, divisions and factorizations
16.Gunakasamuchyah	The factors of the sum is equal to the sum of the factors	-

1. . Ekadhikena Purvena : (By one more than the previous one)

If the sum of two unit digits of the two numbers totals to 10 or ,unit digits integer endswith 5 and begins with the multiple of previous integer and one more than the integer.

❖ Examples:

$24 \times 26 = ?$

$= 2 \times 3$(first digit × one more than first digit)6×4(product of unit digit)

$= 6\ 24 = 624$

- Square of $25 = ?$

$= 25 \times 25$
$= 2\ x\ 3$(first digit × one more than first digit)5×5(product of unit digit)

$= 6\ 25$

2. **Nikhilam Navatascaravam Dasatah: (All from 9 and the last from 10)**

This Vedic Mathematical formula is for multiplication of any numbers near to less thanmultiple of 10.

- ▪ Step 1: Subtract the numbers with their closest multiple of 10 and multiply the results.
- ▪ Step 2: Subtract the results with other numbers.
- ▪ Step 3: Write the result of Step 2 in the beginning and result of Step 1 at the end.

❖ Example:

- $99 * 96 = ?$
  - ➢ $100 - 99 = 1 \ and \ 100 - 96 = 4, 1 \times 4 = 04$
  - ➢ $99 - 4 \ or \ 96 - 1 = 95, 95 \ and \ 04$

So, the answer is 9504

3. Urdva – Triyagbhyam: (Vertically and Crosswise)

This Vedic Math formula is for multiplication of any two two-digit numbers,

- ▪ Step 1: Multiply the last digit.
- ▪ Step 2: Multiply numbers diagonally and add them.
- ▪ Step 3: Place Step 1 at the end and Step 2 at the beginning.
- ▪ Step 4: Multiply the first digit of both the number and put it at the most beginning.

Step 5: For the result, more than 2 or more digits, add the beginning digits to the beginning numbers.

❖ Example:

- $54 \times 87 = ?$
  - ➢ $4 \times 7 = 28$
  - ➢ $(5 \times 7) + (4 \times 8) = 35 + 32 = 67$
  - ➢ $5 \times 8 = 40$
  - ➢ $54 \times 87 = 40|67|28 = 4698$

4. Paraavartya Yojajet: (Transpose and adjust)

This Vedic Math formula is for dividing large numbers by number greater than 10.

❖ **Example:**

- 3784 divided by 12.

- ▪ Step 1: Write the negative of the last number of the divisor under the dividend.

$$i.e., 12 = (-2)$$

- ▪ Step 2: Separate the last digit of the dividend from the rest to calculate the

remainder.   378 4

- Step 3: Multiply the first digit with the above result i.e., -2. $3 \times (-2)$
- Step 4: Add the second digit with the result and continue till the last.

  $378 \ 4 = 3(7 - 6)8 \ 4, = 31(8 - 2) \ 4 = 316(4 - 12) = 315(14 - 10)$

  Result: Quotient $= 315$ and Remainder $= 4$

5. Sunyam Samya Samuccaya:(When the sum is the same, the sum is zero)

This is related to equating with zero. For example, as x is common factor in the equation "$14x + 5x \ldots \ldots = 7x + 3x \ldots . .$", x will equal to 0.

❖ Example :

- $9(x + 3) = 4(x + 3)$

According to the definition, Since $x + 3$ is a common factor, $x + 3 = 0$ that's why, x $=$-3

Calculation with a simple algebraic method,

➢ $9x + 27 = 4x + 12$

➢ $5x = -15$

➢ $x = -3$

6. Anurupye – Sunyamanyat: (If one is in ratio the other one is 0)

We use this Sutra in solving a special type of simultaneous simple equations in which the coefficients of 'one' variable are in the same ratio to each other as the independent terms are to each other. In such a context the Sutra says the other variable is zero from which we get two simple equations in the first variable (already considered) and of course give the same value for the variable.

❖ **Example:**

- $3x + 7y = 2, 4x + 21y = 6$

Observe that the y-coefficients are in the ratio 7 : 21 i.e., 1 : 3, which is same as the ratio of independent terms i.e., $2 : 6 \ i.\ e.\ , \ 1 : 3$. Hence the other variable x $= 0$ and $7y = 2$ or $21y = 6$ gives $y = 2/7$

7. Sankalana – Vyavakalanabhyam: (By addition and By subtraction)

In two general equation such as, $ax + by = p$ and $cx + dy = q$, where x and y are unknown values.

➢ $x = (bq - pd)/bc - ad) \ y = (cp - aq)/(bc - ad)$

❖ Example:

- $3x + 2y = 4 \ and \ 4x + 3y = 5$
  - ➢ $x = (10 - 12)/(8 - 9) = 2$
  - ➢ $y = (16 - 15)/(8 - 9) = -1$

8. Puranapuranabhyam: (By the completion or non-completion)

This is a method of completion of polynomials to find its factors.

❖ Example:

- $x^3 + 9x^2 + 24x + 16 = 0$

  ➤ $i.e, x^3 + 9x^2 = -24x - 16$

We know that $(x+3)^3 = x^3+9x^2+27x+27 = 3x + 11$ (Substituting above step).

i.e. $(x + 3)^3 = 3(x + 3) + 2 \ldots$ (write $3x + 11$ n terms of LHS so that we substitute aterm by a single variable).

  ➤ Put $y = x + 3$

  ➤ So, $y^3 = 3y + 2$

  ➤ i.e., $y^3 - 3y - 2 = 0$

Solving using the methods discussed (coefficient of odd power = coefficient of even power)before.

We get $(y + 1)^2 (y - 2) = 0$, So, $y = -1, 2$, Hence, $x = -4, -1$.

9. Chalana – Kalanabhyam:. (Differences and Similarities)

In the first instance, it is used to find the roots of a quadratic equation $7x^2 - 11x - 7 = 0$. Swamiji called the sutra as calculus formula. Its application at that point is as follows. Now by calculus formula, we say: $14x - 11 = \pm\sqrt{317}$

A note follows saying every Quadratic can thus be broken down into two binomial factors.

An explanation in terms of the first differential, discriminant with a sufficient number of examples are given in the chapter 'Quadratic Equations'. In the Second instance under the chapter 'Factorization and Differential Calculus' for factorizing expressions of 3rd, 4th and 5th degree, the procedure is mentioned as 'Vedic Sutras relating to Calana – Kalana – Differential Calculus'. Hence the sutra and its various applications will be taken up at a later stage for the discussion.

10. Yaavadunam: (Whatever the extent of its deficiency)

For the square root of a number close to multiple of 10.

- Step1: Subtract the number by multiple of 10

- Step2: First digit is the subtraction of the number from the result of Step 1

- Step 3: the second digit is the square of result from Step 1

❖ Example:

- Square of 19

  ➤ $= (9 - (10 - 9), (10 - 9) \times (10 - 9) = 81$

11. Vyashtisamanstih: (part and whole)

This solves the equation of polynomials to find its factors by using Paravartya Sutra.

❖ Example:

- $x^3 + 7x^2 + 14x + 18 = 0$

  ➤ $i.e, x^3 + 7x^2 = -14x - 8$

We know that $(x + 3)^3 = x^3 + 9x^2 + 27x + 27 = 2x^2 + 13x + 19$ (Substituting above step).

> ➤ i.e.$(x + 3)^3 = 2x^2 + 13x + 19$

Now we need factorize RHS in terms of (x+3). So apply Paravartya sutra.

Dividing $2x^2 + 13x + 19\ by\ (x + 3)$ gives

> ➤ $2x^2 + 13x + 219 = (x + 3)(2x - 7) - 2$

> ➤ $i.e, (x + 3)^3 = (x + 3)(2x - 7) - 2$

> ➤ $put\ y = x + 3$

So,y³=y(2y+1)-2 Hence, x= -2, 4, 1, -1

12. Shesanyankena Charamena: (The remainders by the last digit)

This sutra gives you the process of converting fractions to decimals.

❖ Example: 1/7

- ▪ As seen earlier successive remainders are 1, 3, 2, 6, 4 and 5.
- ▪ We will write them as 3, 2, 6, 4, 5 and 1.
- ▪ Multiply them with the last digit of divisor (7): 21, 14, 42, 28, 35 and 7
- ▪ Now take their last digits and that's the final answer: 0.142857.

13. Gunitasamuchyah: (The product of the sum is equal to the sum of the product)

For the quadratic equation, in order to verify the result, the product of the sum of the coefficients of x in the factors is equal to the sum of the coefficients of x in the product.

❖ Example:

- • $(x + 3)(x + 2) = x^2 + 5x + 6$
  - ➤ $(1 + 3)(1 + 2) = 1 + 5 + 6$
  - ➤ $12 = 12$; thus verified.

14. Gunakasamuchyah: (The factors of the sum is equal to the sum of the factors)

For quadratic equation, the factor of the sum of the coefficients of 'x' in the product is equalto the sum of the coefficients of 'x' in the factors.

Real life applications of Vedic Mathematics:

By using Vedic Mathematics tricks we can easily calculate real life problems likeTemperature Conversions, Distance Conversions, Adding Time etc.

Temperature Conversions:

This is a shortcut to convert Fahrenheit to Celsius and vice versa. Take 30 away from the Fahrenheit, and then divide the answer by two.

This is your answer in Celsius.

Example: convert 74 Fahrenheit into Celsius

- ➢ 74 Fahrenheit − 30 = 44. Then divide by two, 22 Celsius.
- ➢ 74 Fahrenheit = 22 Celsius.
- ➢ Celsius to Fahrenheit just do the reverse:
- ➢ Double it, and then Celsius
- ➢ Celsius double it, is 60, then add 30 is 90
- ➢ 30 Celsius = 90 Fahrenheit.

Distance Conversions:

Kilometers to Miles:

This is a useful method for when travelling between imperial and metric countries and need to know what kilometers to miles are.

The formula to convert kilometers to miles is number of (kilometers $/ 8$) x 5

Example: Convert 80 kilometres into miles

- ➢ $80/8 = 10$
- ➢ Multiplied by 5 is 50 miles.
- ➢ Another example 40 kilometers
- ➢ $40 / 8 = 5$
- ➢ $5 X 5 = 25$ mile.

.2 Miles to Kilometers:

This is a useful method for when travelling between imperial and metric countries and need to know what miles to kilometers are.

The formula to convert miles to kilometers is number of (miles $/5)\times8$

Example: Convert 80 miles into kilometers

$80/5 = 16$

- ➢ Multiplied by 8 is 128
- ➢ 128 kilometers.

Kilos to Pounds:

This is the shortcut method to convert Kilos to Pounds, and Vice Versa.

Example: Convert 86 kilos into pounds:

- ➢ **Step-1**: multiplies the kilos by two.

To do this, just double the kilos.

$86 \ X \ 2 = \ 1$

➢ **Step-2:** Divide the answer by ten.

To do this, just put a decimal point one place in from the right

$172 \ / \ 10 = \ 17.2$

➢ **Step-3**: Add step two's answer to step one's answer.

$172 + 17.2 = \ 189.2$

$86 \ \text{Kilos} = 189.2 \ \text{pounds}$

Vinculum numbers Conversions:

Vinculum Process or Vinculum Numbers are the very basics of Vedic Mathematics. Vinculum Numbers is concept used in Vedic Mathematics and are those numbers which have atleast 1 digit which is negative (having bar over them). Also called as Bar Numbers.

Vinculum numbers are used especially whenever we have higher digits (6, 7, 8, 9) in a number for carrying out Subtraction, Multiplication, Division, etc. Like any other number, Vinculum Number is a hypothetical number used in Vedic Mathematics to make calculations faster.

Converting Vinculum numbers to Normal numbers:

Example: Convert vinculum number $43\bar{3}5$ normal number

➢ Here 5 is a negative number & others are positive, so this number is a Vinculum Number. We can simplify this number as

➢ $43\bar{3}5 = 4000 + 300 + 30 - 5 = 4325$

Converting Normal numbers to Vinculum numbers:

Here the Vedic sutra "Nikhilam Navatascaramam Dashatsh" and "Ekadhikena Purvena" sutras are used.

Example: Convert Normal number 36 to Vinculum number.

We move from Right to Left (R>>L).

➢ Step 1: Identify the digit from right hand side which is greater than 5. Here the number is 6.

➢ Step 2: Here we apply sutra " All from 9 & last from 10". As 6 is our last digit we subtractit from 10. We get 4, write it as 4

➢ Step 3: Now move towards left hand side but there is no digit that is greater than 5. (So, alfrom 9 is not applicable here.)

➢ Step 4: Now we use "one more than previous" Here previous number is 3, So $3 + 1 = 4$. Answer:

$44(40 - 4 = 36).$

Adding Time:

This is the shortcut method to adding time by using Vedic maths application Suddha(purification).

Example: Let's add 1 hour 45 minutes and 4 hours 24 minutes.

Now, make both time values as numbers and add together

- ➢ $145 + 425 = 570$

   Now, increment 40

- ➢ $570 + 40 = 610$

Now, the final answer is 6 hours 10 minutes

No matter what the hours and minutes are, just add 40 as a time constant to the sub total.

CONCLUSION:

Vedic Mathematics is the most significant and efficient mental mathematics system. As like another branch of science and mathematics, this is also a pure science which gives the ability to solve tedious and cumbersome arithmetic operations mentally and increase the accuracy of the result. This project concludes that Vedic mathematics techniques/sutras significantly reduce the time required for completing some basic mathematical calculations for real life problems. The Vedic Mathematics techniques can reduce the burden and overhead of students in competitive examinations while solving quantitative aptitude and reasoning problems. It is considered as one of the short cut method for solving basic mathematical operations.

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