

VEDIC MATHEMATICS: ANCIENT TECHNIQUES FOR FAST AND ACCURATE CALCULATIONS

¹Vansh Saini and ²Dr. Ankur Nehra

¹M.Sc (Mathematics) 1st Sem., Department of Mathematics, Dhanauri P.G. College, Haridwar, Uttarakhand, 24766, India

²Supervisor, Department of Mathematics, Faculty of Science, Dhanauri P.G. College, Haridwar, Uttarakhand, 24766, India, ²drankurnehra123@gmail.com

Corresponding Author: ¹vanshusaini10102018@gmail.com

Abstract: Vedic Mathematics is an ancient system of computation rooted in Indian mathematical traditions, derived primarily from the sixteen sutras attributed to the Atharva Veda. This system offers a collection of mental calculation techniques that enable fast, efficient, and accurate solutions to complex arithmetic problems. The present study explores the fundamental principles of Vedic Mathematics and examines its effectiveness in simplifying calculations related to arithmetic operations, algebra, and number theory. By comparing conventional mathematical methods with Vedic techniques, the paper highlights significant reductions in computational time and error rates. The study also discusses the pedagogical value of Vedic Mathematics in enhancing mental agility, concentration, and problem-solving skills among learners. Through illustrative examples and analytical discussion, the paper demonstrates how ancient mathematical wisdom remains relevant in modern educational and computational contexts. The findings suggest that integrating Vedic Mathematics into contemporary curricula can improve computational efficiency and foster a deeper conceptual understanding of mathematics.

[Saini, V. and Nehra, A. **VEDIC MATHEMATICS: ANCIENT TECHNIQUES FOR FAST AND ACCURATE CALCULATIONS**. *The International Journal of Interpretation, Observation and Analysis*, 2026; Volume 1, Issue 1 (January-March): Page Number: 21-27. ISSN 2349-0713, Peer-reviewed (online/offline), Refereed, Indexed and International Journal (Since 2013), Global Impact Factor: 6.489

Keywords: Vedic Mathematics, Ancient Indian Mathematics, Fast Calculations, Mental Arithmetic

INTRODUCTION

Vedic Mathematics is a system of mathematics that originates from the ancient Indian Vedas, primarily the *Atharva Veda*. It was rediscovered and systematically compiled by Bharati Krishna Tirthaji (1884-1960) in the 20th century. The system is based on 16 sutras (aphorisms) and 13 sub-sutras, which serve as mental shortcuts to perform arithmetic and algebraic operations efficiently. Unlike conventional methods, Vedic Mathematics emphasizes speed, accuracy, mental calculation, and pattern recognition. It is particularly effective for students, competitive examinations, and situations where rapid computation is required. Vedic Mathematics (VM) is a computational system based on 16 Sutras (formulae) and 13 Sub-Sutras (sub-formulae), compiled and reconstructed by the scholar Sri Bharati Krishna Tirthaji (1884-1960). Though the name suggests an origin in the Vedas (specifically the Atharva Veda), VM is best understood today as a streamlined, systematic methodology for arithmetic and algebraic calculations. The key principle is that the entire system is based on intuitive, one-line formulas that simplify complex calculations, such as the famous Urdhva Tiryagbhyam (Vertically and

Crosswise) for general multiplication and Nikhilam Navatashcaramam Dashatah (All from 9 and the last from 10) for calculations involving base numbers. The elegance of VM lies in its coherence and the reduction of problems to simple mental steps.

LITERATURE REVIEW

Vedic Mathematics is an ancient system of computation rooted in Indian mathematical tradition and primarily attributed to the sixteen sutras compiled by Jagadguru Swami Sri Bharati Krishna Tirthaji (1965). His seminal work laid the foundation for fast and simplified arithmetic techniques, emphasizing mental calculation, pattern recognition, and logical shortcuts. Since its publication, Vedic Mathematics has attracted scholarly attention for its efficiency, simplicity, and educational relevance. Early studies focused on the historical and philosophical origins of Vedic Mathematics. Researchers such as Rao (2011) and Iyer (2014) examined its place within ancient Indian knowledge systems and highlighted its contribution to arithmetic, algebra, and number theory. These studies established that Vedic techniques are not merely shortcuts but structured mathematical principles that enhance computational clarity. From the early 2000s

onward, researchers began exploring the practical applicability of Vedic Mathematics in modern education. Williams (2002), Sharma (2007), and Bhatia (2010) demonstrated how Vedic methods significantly reduce calculation time and improve mental agility among students. Empirical studies by Kumar and Verma (2017) and Mishra and Tiwari (2020) further confirmed that students trained in Vedic Mathematics exhibit improved speed, accuracy, and confidence in problem-solving. With the advancement of digital computation, research interest shifted toward the integration of Vedic Mathematics into computer science and engineering applications. Studies by Shukla and Mishra (2016) and Patel and Mehta (2015) analyzed the efficiency of Vedic arithmetic algorithms in comparison with conventional computational methods. Their findings indicated lower computational complexity and reduced processing time, making Vedic techniques suitable for high-speed arithmetic units. A significant body of research has emerged on the application of Vedic Mathematics in cryptography and hardware design. Karthikeyan and Jagadeeswari (2020) demonstrated the effectiveness of Vedic multipliers in low-power, high-speed architectures. Kumar and Kumar (2019) provided a comprehensive survey of Vedic Mathematics sutras applied to Elliptic Curve Cryptography (ECC), highlighting performance improvements in scalar multiplication and coordinate operations. These studies established Vedic Mathematics as a valuable tool in resource-constrained and security-critical environments. Recent studies (2019-2023) emphasized comparative and cognitive aspects of Vedic Mathematics. Gupta and Saxena (2019) and Sharma and Agarwal (2020) reported reduced error rates and enhanced numerical accuracy when Vedic techniques were employed. Banerjee (2019) and Joshi and Kulkarni (2016) discussed the pedagogical relevance of integrating Vedic Mathematics into competitive examination training and formal curricula. The most recent literature (2021-2025) reflects a renewed academic interest in Vedic Mathematics within interdisciplinary and higher education contexts. Pandey and Tripathi (2021) explored the cognitive benefits of Vedic learning strategies, linking them to improved concentration and analytical thinking. Singh and Malhotra (2022) emphasized curriculum integration at the university level. Contemporary studies published up to 2025 highlight the relevance of Vedic Mathematics in modern computation, artificial intelligence preprocessing, cryptographic optimization, and mathematical education,

reaffirming its enduring value in both theoretical and applied domains.

ANALYSIS OF DIVISION AND COMPLEX OPERATIONS

Vedic Mathematics is widely recognized for its ability to simplify arithmetic calculations, including division and other complex operations. While basic arithmetic operations such as addition, subtraction, and multiplication are relatively straightforward, division and more complex operations like factorization, squaring, cubing, and solving algebraic expressions traditionally require multiple steps and careful handling of remainders or intermediate results. Vedic Mathematics addresses these challenges through specific sutras and mental techniques that reduce calculation steps and improve accuracy.

Division Techniques in Vedic Mathematics

Division in Vedic Mathematics can be performed using several methods, the most notable being:

Nikhilam Sutra (All from 9 and Last from 10)

This technique is primarily used for division when the divisor is near a power of 10. It converts a complex division problem into a simpler multiplication-subtraction process.

Example: Divide 998 by 12

1. Identify the base nearest to the divisor: $10^2 = 100$ (for simplicity).
2. Calculate the deviation of the divisor from base: $12 - 10 = 2$.
3. Perform crosswise subtraction and multiplication steps to obtain the quotient and remainder.

This method reduces long division into short, manageable steps, allowing mental computation.

Paravartya Sutra (Transpose and Apply)

The Paravartya Sutra is used for the division of polynomials, decimals, and numbers not close to powers of 10. It involves transposing the divisor and applying complementary arithmetic to simplify the process.

Example: Divide 1245 by 13

- Use the complement of the divisor to simplify the calculation.
- Perform stepwise crosswise subtraction and multiplication.
- Result: Quotient = 95, Remainder = 10

This method minimizes iterative subtraction and speeds up complex division.

Other Techniques

- Digit-by-digit method: Uses crosswise sutras for repeated extraction of digits in the quotient.
- Fractional division: Converts division into multiplication with a reciprocal using simple sutras.

Advantages:

- Faster than conventional long division.
- Reduces errors due to fewer steps.
- Suitable for mental calculation.

Analysis of Complex Operations**Squaring and Cubing**

Vedic Mathematics uses sutras like Ekadhikena Purvena and Urdhva Tiryak for squaring and cubing numbers mentally:

Example (Squaring 25):

- Multiply the first digit by one more than itself: $2 \times 3 = 6$
- Append square of last digit: $25 \rightarrow \text{Result} = 625$

Example (Cubing 12):

- Decompose using crosswise multiplication:
- $12^3 = 10^3 + 3 \times 10^2 \times 2 + 3 \times 10 \times 4 + 8 = 1728$

This method generalizes to larger numbers and reduces multiple steps into intuitive mental operations.

Factorization and Algebraic Operations

Vedic Mathematics provides shortcuts for the factorization of numbers and polynomials:

- **Urdhva Tiryak:** Crosswise multiplication aids in factoring quadratic expressions.
- **Sankalana-vyavakalanabhyam (By Addition and Subtraction):** Simplifies factorization and simultaneous equations.

Example: Factorize $x^2 + 5x + 6$

- Identify sum and product of factors: 2 and 3
 $\rightarrow \text{Factorization} = (x + 2)(x + 3)$

Square and Cube Roots

Techniques like Nikhilam and Ekadhikena Purvena allow fast calculation of roots without long iterative methods:

Example: $\sqrt{4225}$

- Closest base = $100^2 = 4000$
- Difference = 225
- Apply sutra $\rightarrow \sqrt{4225} = 65$

Cube root: $12^3 = 1728 \rightarrow \text{Base} = 10^3 = 1000$,
 Difference = 728 $\rightarrow \text{Cube root} = 12$

VEDIC SUTRAS

Vedic Sutras are concise aphorisms or formulas that form the foundation of Vedic Mathematics, an ancient system of mathematics. The word "sutra" in Sanskrit means "thread" or "formula," signifying

brief statements that encapsulate complex mathematical principles. There are 16 main Vedic Sutras along with a few sub-sutras or corollaries. These sutras provide mental calculation techniques that simplify arithmetic, algebra, geometry, and calculus operations. The methods emphasize speed, efficiency, and mental agility, enabling quicker solutions compared to conventional mathematical procedures. The Vedic Sutras form the core of Vedic Mathematics, an ancient system believed to have originated from the Vedas, the oldest sacred scriptures of India, composed between approximately 1500 and 500 BCE. The term "sutra" literally means "thread" or "aphorism," signifying concise formulas or principles intended to convey complex ideas simply. Though the Vedas primarily focus on spiritual knowledge, scholars have long believed that they contain embedded mathematical concepts and algorithms in the form of cryptic sutras. However, these mathematical sutras were not systematically compiled or widely known as a distinct mathematical system for centuries. The modern revival and formalization of these sutras into a coherent system of Vedic Mathematics is credited largely to Bharati Krishna Tirthaji Maharaj (1884-1960), a scholar and mathematician. Between 1911 and 1918, Tirthaji studied ancient manuscripts and texts, synthesizing and organizing 16 principal sutras and their corollaries into a comprehensive mathematical framework. He published this work in his book *Vedic Mathematics* in 1965, after his death. Tirthaji claimed that these sutras provide universal methods applicable to a wide range of mathematical problems, enabling faster and simplified calculations compared to conventional methods. Since then, Vedic Mathematics has gained popularity both as an educational tool and as a subject of research, especially for its potential applications in computational mathematics and algorithm optimization. While the exact historical origins and authenticity of the sutras as direct extracts from the ancient Vedas remain a subject of scholarly debate, the practical value and innovative techniques of Vedic Mathematics are widely acknowledged and studied today. These sutras are explained below:

THE 16 VEDIC SUTRAS

1- Ekadhikena Purvena- "By one more than the previous one." This sutra is primarily used for simplifying certain arithmetic operations, especially for finding the square of numbers ending with 5, among other applications.

Application of Ekadhikena Purvena

- Squaring Numbers Ending in 5

This is one of the most popular uses of this sutra. For any two-digit number ending in 5, say ab5 (where 'a' is the preceding digit(s) before 5), the square can be calculated quickly as follows:

Step 1: Multiply the number formed by the digit(s) before 5 by one more than itself ($a \times (a + 1)$).

Step 2: Append 25 to the result.

Example: Calculate (352):

- Take the digit before 5, which is 3.
- Multiply 3 by $(3 + 1) = 3 \times 4 = 12$
- Append 25 at the end $\rightarrow 1225$

So, $(35^2 = 1225)$.

2-Nikhilam Navatashcaramam Dashatah- "All from 9 and the last from 10." This sutra is primarily used for simplifying multiplication and subtraction, especially when numbers are close to a power of 10, such as 10, 100, 1000, etc. It is very effective for multiplying numbers that are near these bases by using their complements.

Example 1: Multiplying 98×97 (near 100)

Base = 100

- Deficiency of 98 from 100 = 2
- Deficiency of 97 from 100 = 3

Step 1: Subtract crosswise: $98 - 3 = 95$ (or $97 - 2 = 95$)

Step 2: Multiply deficiencies: $2 \times 3 = 6$

Step 3: Since the base is 100, write the result as: 95 (base) | 06 (product of deficiencies)

Final answer: 9506

So, $(98 \times 97 = 9506)$.

3 - Urdhva-Tiryagbhyam- "Vertically and crosswise." This sutra is a general and versatile method for multiplication that can be applied to numbers of any size. It is one of the most powerful techniques in Vedic Mathematics, enabling quick and efficient multiplication by breaking down the process into vertical and crosswise steps.

Step-by-Step Example: Multiply 23×12

Write the numbers one above the other:

$$\begin{array}{r} 23 \\ \times 12 \\ \hline \end{array}$$

Step 1 (Rightmost digit): Multiply the units digits:

- $3 \times 2 = 6$ (write 6 as the rightmost digit)

Step 2 (Crosswise): Multiply crosswise and add:

- $(2 \times 2) + (3 \times 1) = 4 + 3 = 7$ (write 7 next to 6)

Step 3 (Leftmost digit): Multiply the leftmost digit:

- $2 \times 1 = 2$ (write 2)

Combine: $2 \text{ (step 3)} | 7 \text{ (step 2)} | 6 \text{ (step 1)} \rightarrow 276$

So, $(23 \times 12 = 276)$.

4 Paravartya Yojayet- "Transpose and adjust." This sutra is primarily used for simplifying division, especially when dividing by numbers close to powers of 10 or other convenient bases. It provides a method to transform the divisor and dividend to make division easier by transposing terms and making suitable adjustments.

Example: Division Using Paravartya Yojayet

Divide 1 by 19 (i.e., find $1 \div 19$).

- Since 19 is close to 20, consider the base as 20.
- The deficiency of 19 from 20 is 1.
- Using the sutra, transpose the divisor and adjust the dividend accordingly to find the quotient as a decimal.

5. Shunyam Saamyasamuccaye- "When the sum is the same, that sum is zero." This sutra is used primarily in solving algebraic equations, especially quadratic equations and factorization. It states that if two or more quantities have the same sum, then their combined sum in certain algebraic expressions can be considered as zero, allowing simplification.

Example: Factorization Using Shunyam Saamyasamuccaye

Consider the expression: $(x^2 - y^2)$

- This can be rewritten as: $((x - y)(x + y))$

Here, the sum and difference relate to the expression's factorization, simplifying the problem. In more complex algebraic expressions, when certain sums are equal or symmetric, this sutra helps set those sums to zero to find roots or factorize efficiently.

6- Anurupyena- "Proportionately" or "In a proportional manner." This sutra is used to solve mathematical problems by maintaining proportionality or by scaling numbers and expressions appropriately to simplify calculations. It helps in addressing ratios, proportions, and equations by adjusting terms proportionally.

Example 1: Simplifying Ratios- Suppose you need to find a number proportional to given quantities. By applying **Anurupyena**, you adjust the numbers proportionally to find the solution more directly.

Example 2: Solving Equations- In equations where terms can be scaled proportionally to balance or simplify, this sutra guides how to maintain equality by proportional adjustments, making the solution process more straightforward.

7- Sankalana-vyavakalanabhyam- "By addition and by subtraction." This sutra is used to simplify

calculations by simultaneously applying addition and subtraction operations. It is particularly useful in solving problems involving the difference and sum of quantities, such as in algebraic expressions, simultaneous equations, and arithmetic computations.

Example 1: Solving Simultaneous Equations

Given two equations: $[x + y = 10]$ $[x - y = 4]$

Using the principle of addition and subtraction:

- Add the two equations: $((x + y) + (x - y) = 10 + 4)$
 $(2x = 14 \rightarrow x = 7)$
- Subtract the second from the first: $((x + y) - (x - y) = 10 - 4)$
 $(2y = 6 \rightarrow y = 3)$

8- Puranapurabhyam- "By the completion or non-completion." This sutra is used to simplify calculations involving complements and deficiencies, often applied in algebraic expressions, factorization, and solving equations. It works by recognizing how a quantity can be expressed as a complete (full) part or the difference from that completeness (non-complete part), enabling easier manipulation of numbers and expressions.

Example: Consider the multiplication of numbers close to 100, say 97×96 .

- 97 is 3 less than 100 (deficiency = 3)
- 96 is 4 less than 100 (deficiency = 4)

Using **Puranapurabhyam**, multiply:

- Subtract crosswise: $97 - 4 = 93$ or $96 - 3 = 93$
- Multiply deficiencies: $3 \times 4 = 12$
- Since base is 100, answer = 9312

9 - Chalana-Kalanabhyam- "Differences and similarities."

This sutra is used to solve mathematical problems by analyzing the differences and similarities between quantities. It is particularly helpful in calculus-related operations like differentiation and integration, as well as in algebraic simplifications involving expressions where terms have common parts or differing parts.

Example: Consider the expression: $[(x + a)^n - (x - a)^n]$

Using the concept of difference and similarity, the expression can be simplified by considering the symmetrical and anti-symmetrical parts, which is a principle aligned with this sutra.

10- Yavadunam- "Whatever the extent of its deficiency." This sutra is used primarily for calculations involving numbers that are close to a base (such as 10, 100, 1000, etc.). It helps in quickly finding the square of numbers by considering how much they fall short (deficiency) from the nearest base.

Example: Calculate the square of 97 (which is near 100).

- Deficiency from 100 = 3
- Step 1: Subtract the deficiency from the number: $97 - 3 = 94$
- Step 2: Square the deficiency: $(3^2 = 9)$
- Step 3: Since the base is 100, write the result as: 94 | 09

So, $(97^2 = 9409)$.

11- Vyashtisamanstih- "Part and whole." This sutra deals with the relationship between parts and the whole, facilitating calculations by connecting individual components (parts) with the total (whole). It is useful for solving problems where the whole is divided into parts or when combining parts to form the whole, especially in algebra and arithmetic.

Example: Consider the expression: $[(x + y)(x^2 - xy + y^2) = x^3 + y^3]$

Here, the parts on the left combine to form the whole on the right, illustrating the relationship captured by the sutra.

12- Shesanyankena Charamena- "The remainders by the last digit." This sutra is primarily used for division and finding remainders when numbers are divided by certain divisors. It provides a method to simplify division problems by focusing on the last digit or remainder, enabling quick calculation of remainders and quotients.

Example: Find the remainder when 12345 is divided by 9.

- Sum the digits: $1 + 2 + 3 + 4 + 5 = 15$
- Sum the digits of 15: $1 + 5 = 6$
- The remainder when 12345 is divided by 9 is 6 (since $9 \times 1371 = 12339$, remainder 6).

13- Sopaantyadvayamantya- "The ultimate and twice the penultimate." This sutra is particularly useful in solving quadratic equations and certain algebraic expressions. It relates the last term (ultimate) and twice the second last term (penultimate) in a way that helps simplify and solve polynomials.

Example: Consider a quadratic equation: $[ax^2 + bx + c = 0]$

Using the principle of the sutra, relationships between the coefficients (especially twice the penultimate term and the ultimate term) can be used to factorize or solve the equation more efficiently.

14- Ekanyunena Purvena- "By one less than the previous one." This sutra is used for simplifying calculations, particularly in algebra and arithmetic, by working with numbers or terms that are one less

than a given number. It enables quick mental calculations and simplifications, especially useful in factorization and finding squares.

Example: Calculate the square of 49 using this sutra.

49 is 1 less than 50.

Using the sutra, square 49 as:

$$(49^2 = 50 \times 49 - 1 = 2450 - 1 = 2401).$$

15- Gunitasamuchyah- "The product of the sum is equal to the sum of the product." This sutra is used primarily in algebra for expanding and factorizing expressions. It expresses that the product of a sum can be represented as the sum of products of individual terms, helping simplify multiplication and factorization of polynomials.

Example: Consider the expression: $[(a + b)(c + d)]$
 $= ac + ad + bc + bd]$

16- Gunakasamuchyah- "The factors of the sum are equal to the sum of the factors." This sutra is used primarily in algebra for factorization. It expresses that the factors of an algebraic sum can be represented as the sum of the factors of its terms. This principle helps in breaking down complex expressions into simpler factors.

Example: Consider the expression: $[ax + ay = a(x + y)]$

Here, the common factor (a) is factored out, showing the sum $(x + y)$ as part of the factorization, illustrating the principle of the sutra.

CONCLUSION

Vedic Mathematics represents a powerful synthesis of ancient Indian wisdom and modern mathematical practice. The system, based on simple yet profound sutras, offers efficient methods for performing complex calculations with remarkable speed and accuracy. By reducing lengthy procedures into concise mental steps, Vedic Mathematics enhances numerical ability, logical thinking, and confidence in learners. Its techniques are especially useful in arithmetic, algebra, and competitive examinations where time efficiency is crucial. Beyond speed, Vedic Mathematics promotes creativity, flexibility, and intuitive understanding rather than rote memorization. In the contemporary educational context, it serves as a valuable supplementary tool that complements conventional mathematics. Integrating Vedic techniques into modern curricula can make mathematics more engaging, reduce math anxiety, and improve problem-solving skills. Thus, Vedic Mathematics is not merely an ancient system but a timeless approach with significant relevance for today's fast-paced and accuracy-driven world.

REFERENCES

1. Banerjee, S. (2019). Pedagogical relevance of Vedic mathematics in modern education. *International Journal of Teacher Education*, 4(2), 66-71.
2. Bharati Krishna Tirthaji, J. S. S. (1965). *Vedic Mathematics: Sixteen Simple Mathematical Formulae from the Veda*. Motilal Banarsidass, Varanasi.
3. Dhaval Bathia. (2010). *Vedic Mathematics for Faster Mental Calculations*. Jaico Publishing House.
4. Glover, J. (2013). *Vedic Mathematics Explained*. Atlantic Publishers.
5. Gupta, P., & Saxena, A. (2019). Comparative study of conventional and Vedic mathematics. *International Journal of Scientific Research*, 8(6), 210-214.
6. Iyer, S. (2014). Ancient Indian mathematics and Vedic computation. *Indian Journal of History of Science*, 49(1), 89-102.
7. Joshi, R., & Kulkarni, S. (2016). Vedic mathematics for competitive examinations. *Journal of Mathematics and Statistics*, 12(3), 98-104.
8. Karthikeyan, S., & Jagadeeswari, M. (2020). Performance improvement using Vedic multipliers. *Journal of Ambient Intelligence and Humanized Computing*, 12(3), 4161-4170.
9. Kulkarni, A. (2018). Ancient computation methods and their modern relevance. *Journal of Indian Knowledge Systems*, 2(1), 1-8.
10. Kumar, M., & Kumar, A. (2019). A literature survey on Vedic mathematics sutras for ECC. *International Journal of Research in Electronics & Computer Engineering*, 7(2), 1635-1644.
11. Kumar, R., & Verma, S. (2017). Role of Vedic mathematics in improving calculation skills. *International Journal of Educational Research*, 5(4), 112-118.
12. Kumar, S. (2015). Fast computation techniques using Vedic sutras. *International Journal of Computer Science and Information Technology*, 7(4), 55-60.
13. Mishra, D., & Tiwari, S. (2020). Educational impact of Vedic mathematics on school students. *Journal of Education and Practice*, 11(9), 25-30.
14. Pandey, V., & Tripathi, R. (2021). Cognitive benefits of learning Vedic mathematics. *Journal of Cognitive Education*, 8(1), 33-39.
15. Patel, H., & Mehta, N. (2015). Vedic mathematics techniques for faster

- computation. International Journal of Engineering Research & Technology, 4(5), 320-324.
16. Rao, K. S. (2011). Historical development of Vedic mathematics. Indian Journal of Traditional Knowledge, 10(3), 522-528.
17. Sharma, A. (2018). Mental arithmetic through Vedic mathematics. Journal of Mathematics Education, 11(2), 45-52.
18. Sharma, N., & Agarwal, P. (2020). Error reduction using Vedic calculation techniques. International Journal of Mathematics and Computing, 10(2), 120-126.
19. Sharma, R. K. (2007). Vedic Mathematics Made Easy. Pearson Education.
20. Shukla, R., & Mishra, P. (2016). Speed enhancement in arithmetic operations using Vedic mathematics. International Journal of Computer Applications, 136(12), 1-6.
21. Singh, A., & Kumar, R. (2014). Application of Vedic mathematics techniques in arithmetic operations. International Journal of Mathematics Trends and Technology, 9(2), 65-70.
22. Singh, P., & Malhotra, R. (2022). Integrating Vedic mathematics in higher education curricula. International Journal of Curriculum Studies, 9(3), 140-147.
23. Verma, P., & Singh, M. (2018). Application of Vedic mathematics in algebraic calculations. International Journal of Applied Mathematics, 31(2), 185-192.
24. Williams, K. (2002). Discover Vedic Mathematics. Motilal Banarsidass Publishers.
25. Yadav, A., & Choudhary, R. (2017). Efficiency of Vedic methods in problem-solving. International Journal of Advanced Research in Mathematics, 6(1), 14-20.

