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Deepa Makholia

Department of Mathematics,
M.B.G.P.G. College Haldwani,
Nainital, Uttarakhand, India

Amit Kumar

Department of Mathematics,
M.B.G.P.G. College Haldwani,
Nainital, Uttarakhand, India

Surendra Vikram Singh Padiar

Department of Mathematics,
S.B.S. College, Rudrapur,
Uttarakhand, India

Dr. Poonam Miyan

Department of Mathematics,
Lal Bahadur Shastri
Government Post graduate
College Halduchaur, Nainital,
Uttarakhand, India

Corresponding Author:

Amit Kumar

Department of Mathematics,
M.B.G.P.G. College Haldwani,
Nainital, Uttarakhand, India

Harnessing the power of ancient wisdom: Exploring the techniques of Vedic mathematics

Deepa Makholia, Amit Kumar, Surendra Vikram Singh Padiar and Dr. Poonam Miyan

Abstract

Vedic Mathematics is an ancient Indian mathematical system rediscovered from the Vedas. This system, comprising sixteen primary sutras (formulas) and thirteen sub-sutras (sub-formulas), offers efficient and simplified methods for various arithmetic operations. This chapter provides an overview of Vedic Mathematics, highlights its historical significance, explains key sutras, and demonstrates their practical applications through examples and practice problems. Emphasizing the advantages of mental calculations and speed, this chapter aims to inspire a deeper understanding and appreciation of Vedic mathematical techniques.

Keywords: Vedic mathematics, sutras, mental calculation, arithmetic, ancient mathematics, Bharati Krishna Tirthaji, mathematical techniques

1. Introduction

Mathematics is a fundamental aspect of human knowledge, essential for advancements in science, engineering, and technology. Among various mathematical traditions, Vedic Mathematics offers a unique approach to solving mathematical problems with simplicity and elegance. Rediscovered from the ancient Indian scriptures known as the Vedas, this system was compiled into a coherent framework by Bharati Krishna Tirthaji in the early 20th century. His seminal work, "Vedic Mathematics," published in 1965, brought these ancient techniques to the modern world, revolutionizing the way we perceive and perform calculations.

Vedic Mathematics is renowned for its efficiency, enabling rapid and accurate computations that are particularly beneficial for students, professionals, and anyone involved in mathematical problem-solving. This chapter introduces the foundational concepts of Vedic Mathematics, explores some of its most significant sutras, and provides practical examples to illustrate their applications.

1.2 Historical Significance

The Vedas, composed between 1500 and 500 BCE, are ancient Indian texts that encompass a vast range of knowledge, including mathematics. The term "Vedic Mathematics" was coined by Bharati Krishna Tirthaji, who devoted years to studying these scriptures and deciphering the mathematical principles embedded within them. His discoveries revealed a set of sixteen sutras and thirteen sub-sutras that offer a systematic approach to arithmetic operations.

The revival of Vedic Mathematics in the 20th century has had a profound impact on mathematical education and practice. It has provided an alternative to conventional methods, emphasizing mental calculations and innovative techniques that simplify complex problems.

1.3 The Sixteen Sutras

The sixteen sutras form the core of Vedic Mathematics. Each sutra provides a unique method for performing specific types of calculations. Here is an overview of these sutras:

1. Ekadhikena Purvena (By one more than the previous one)
2. Nikhilam Navatashcaramam Dashatah (All from 9 and the last from 10)
3. Urdhva-Tiryagbyham (Vertically and crosswise)
4. Paravartya Yojayet (Transpose and adjust)
5. Shunyam Saamyasamuccaye (When the sum is the same that sum is zero)

6. Anurupye Shunyamanyat (If one is in ratio, the other is zero)
7. Sankalana-Vyavakalanabhyam (By addition and by subtraction)
8. Puranapuranaabhyam (By the completion or non-completion)
9. Chalana-Kalanabhyam (Differences and Similarities)
10. Yaavadunam (Whatever the extent of its deficiency)
11. Vyashtisamanstih (Part and Whole)
12. Shesanyankena Charamena (The remainders by the last digit)
13. Sopaantyadvayamantyam (The ultimate and twice the penultimate)
14. Ekanyunena Purvena (By one less than the previous one)
15. Gunitasamuccayah (The product of the sum is the sum of the product)
16. Gunakasamuccayah (The factors of the sum is the sum of the factors)

1.4 Application of the Sutras

1.4.1 Ekadhikena Purvena: This sutra is particularly useful for squaring numbers ending in 5.

Example: To find the square of 25:

1. Split the number into two parts: 2 and 5.
2. The last part of the answer is always 25.
3. Multiply the first part (2) by one more than itself (3): $2 \times 3 = 6$.
4. The result is 625.

1.4.2 Nikhilam Navatashcaramam Dashatah: This sutra simplifies multiplication of numbers close to a power of 10.

Example: To multiply 98 and 97:

1. Subtract each number from 100

$$- 100 - 98 = 2$$

$$- 100 - 97 = 3$$

2. Cross-subtract to get the first part of the answer:

$$- 98 - 3 = 95 \text{ or } 97 - 2 = 95$$

3. Multiply the remainders to get the second part of the answer:

$$- 2 \times 3 = 6$$

4. Combine the results: 9506.

1.4.3 Urdhva-Tiryagbyham: This versatile sutra applies to various multiplication problems.

Example: To multiply 23 by 12:

1. Multiply vertically and crosswise:

- First, multiply the rightmost digits: $3 \times 2 = 6$.
- Next, cross-multiply and add: $(2 \times 2) + (3 \times 1) = 4 + 3 = 7$.
- Finally, multiply the leftmost digits: $2 \times 1 = 2$.

2. Combine the results: 276.

1.4.4 Paravartya Yojayet: This sutra is useful for solving equations and algebraic expressions.

Example: To solve the equation $(3x + 7 = 10)$:

1. Transpose the constant term to the other side: $(3x = 10 - 7)$.
2. Simplify the equation: $(3x = 3)$.
3. Divide by the coefficient of (x) : $(x = 1)$.

1.4.5 Shunyam Saamyasamuccaye: This sutra is applied when the sum of terms on both sides of an equation is the same.

Example: To solve the equation $(x + 2 = 2 + x)$:

1. Notice that the sum of terms on both sides is the same.
2. The equation holds true for any value of (x) , indicating an identity.

1.4.6 Anurupye Shunyamanyat: This sutra is useful for solving proportional equations.

Example: To solve the equation $(\frac{x}{2} = \frac{3}{6})$:

1. Simplify the right side: $(\frac{3}{6} = \frac{1}{2})$.
2. Since both sides are equal, $(x = 1)$.

1.5 Advantages of Vedic Mathematics: Vedic Mathematics offers a wide range of benefits that make it a valuable tool for both learners and practitioners. Here are some of the key advantages:

1. **Speed and Efficiency:** Vedic Mathematics enables rapid calculations, which is particularly useful in competitive exams, time-sensitive situations, and daily problem-solving. The techniques often reduce complex calculations into simpler, more manageable steps, allowing for quick and accurate results.
2. **Simplicity and Clarity:** The methods in Vedic Mathematics are straightforward and easy to understand. They often rely on simple rules and patterns that can be easily memorized and applied, making mathematics more accessible and less intimidating for learners of all ages.
3. **Enhanced Mental Calculation:** One of the most significant benefits of Vedic Mathematics is its emphasis on mental arithmetic. Many techniques can be performed mentally without the need for pen and paper, which helps to improve mental agility, concentration, and cognitive skills.
4. **Versatility and Flexibility:** The sutras of Vedic Mathematics can be applied to a wide range of mathematical problems, including basic arithmetic, algebra, geometry, calculus, and even complex number theory. This versatility makes it a valuable tool for students, educators, and professionals alike.
5. **Improved Problem-Solving Skills:** By learning and applying the various techniques of Vedic Mathematics, individuals can develop better problem-solving skills. The methods often encourage creative thinking and the ability to approach problems from different angles, leading to more efficient and innovative solutions.
6. **Stronger Foundation in Mathematics:** Vedic Mathematics provides a solid foundation in basic arithmetic operations, which is crucial for understanding more advanced mathematical concepts. The clear and logical structure of the methods helps to build a strong mathematical foundation and fosters a deeper appreciation for the subject.
7. **Reduced Dependence on Calculators:** With Vedic Mathematics, individuals can perform many calculations mentally or with minimal use of calculators. This reduces dependency on electronic devices and enhances self-reliance and confidence in one's mathematical abilities.
8. **Increased Confidence and Enjoyment:** The simplicity and effectiveness of Vedic Mathematics often lead to a greater sense of confidence and enjoyment in learning mathematics. As learners become more proficient in these techniques, they experience less anxiety and

frustration, making the study of mathematics a more positive and rewarding experience.

9. **Applicability to Real-Life Situations:** The techniques of Vedic Mathematics can be applied to real-life situations, such as budgeting, shopping, cooking, and other everyday tasks that involve calculations. This practical applicability makes the methods highly relevant and useful in daily life.
10. **Cultural and Historical Significance:** Learning Vedic Mathematics provides a connection to ancient Indian culture and heritage. It offers an appreciation for the historical development of mathematical thought and the contributions of ancient scholars to the field of mathematics.
11. **Educational Benefits:** Incorporating Vedic Mathematics into the curriculum can enhance the overall educational experience. It can serve as a supplementary tool that complements traditional mathematical teaching methods, providing students with alternative approaches to learning and understanding mathematical concepts.

Vedic Mathematics is a powerful and versatile system that offers numerous advantages, from speeding up calculations and enhancing mental agility to improving problem-solving skills and boosting confidence. Its simplicity, flexibility, and practicality make it a valuable addition to the mathematical toolkit of students, educators, and professionals alike.

2. Conclusion

Vedic Mathematics stands out as a remarkable system of mathematical techniques that offer simplicity, efficiency, and speed. Rooted in ancient Indian wisdom, these methods have been revitalized to benefit modern learners and practitioners. The sixteen sutras, each with its unique approach to solving mathematical problems, demonstrate the depth and versatility of this ancient knowledge.

By incorporating Vedic Mathematics into daily practice, individuals can enhance their calculation skills, improve mental agility, and develop a deeper appreciation for the elegance of mathematical thought. The examples and practice problems provided in this chapter serve as a foundation for further exploration and mastery of Vedic techniques. As learners progress, they will find that these ancient methods not only simplify complex calculations but also instill a greater sense of confidence and enjoyment in the study of mathematics.

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