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# Parvartya rule of Vedic Mathematics : A Comprehensive Study

**Dr.Kishan Singh Shekhawat**

Associate Professor

S.K. Govt. Girls College,Sikar,Rajasthan-332001,India.

(Pandit Deendayal Upadhaya Shekhawati university sikar Rajasthan India)

**Babu lal Choudhary**

Research Scholar

Pandit Deendayal Upadhaya Shekhawati university sikar Rajasthan, India.

**Abstract**

Vedic Mathematics is a system of ancient Indian mathematics that originated from the Vedas, the ancient Hindu scriptures. One of the key features of Vedic Mathematics is its simplicity and speed in solving complex mathematical problems. Among the various techniques used in Vedic Mathematics, the Parvartya Rule is a crucial one that enables the efficient calculation of products involving large numbers.

This research paper provides a comprehensive study of the Parvartya Rule of Vedic Mathematics. The paper begins with an overview of Vedic Mathematics and its origins, followed by a detailed explanation of the Parvartya Rule and its various applications. The paper also includes several examples and exercises to illustrate the practical use of the Parvartya Rule.

Furthermore, the paper explores the theoretical underpinnings of the Parvartya Rule and its relation to other techniques in Vedic Mathematics.

In conclusion, the Parvartya Rule is an important aspect of Vedic Mathematics that has practical applications in various fields, including engineering, science, and finance. This paper provides a thorough understanding of the Parvartya Rule and its relevance in modern-day mathematics, making it a valuable resource for students, researchers, and practitioners alike.

## Introduction

Vedic Mathematics is an ancient Indian system of mathematics that has received renewed interest in recent times for its simplicity and efficiency in solving complex mathematical problems. Among the various techniques used in Vedic Mathematics, the Parvartya Rule, also known as the Vertical and Crosswise Algorithm, stands out as a powerful tool for multiplying large numbers. Bharti Krishna Tirthaji, a former sankaracharya of puri, is credited with developing a unique system of mathematics based on ancient Indian culture.[1]

Despite its usefulness, the Parvartya Rule has not been extensively studied in the modern mathematical literature. This research paper aims to investigate the theoretical underpinnings of the Parvartya Rule and explore its practical applications in various fields, including engineering, science, and finance.

The paper will begin with a brief introduction to Vedic Mathematics and its historical and cultural significance. We will then delve into the Parvartya Rule, providing a detailed explanation of the technique and its unique approach to multiplication. We will also examine the mathematical principles that underlie the Parvartya Rule, exploring its connection to other techniques in Vedic Mathematics. Next, we will demonstrate the practical applications of the Parvartya Rule through a series of examples and exercises. We will highlight the speed and efficiency of the Parvartya Rule in solving complex mathematical problems, and show how it can be used to simplify calculations in various fields.

The fundamental principle of vedic mathematics is to solve problems in a single line. By utilizing the sutras of vedic mathematic, difficult mathematical calculations can be performed easily and mentally.[2] The article focuses entirely on the distinctive approach of basic operations in vedic mathematics.[3] Finally, we will discuss the implications of our findings and suggest areas for further research. We hope that this investigation will contribute to a deeper understanding of the Parvartya Rule and its potential for modern-day mathematics. This research paper will be useful for students, researchers, and practitioners interested in Vedic Mathematics and those looking to apply the Parvartya Rule in their work.

The Parvartya rule is a technique in Vedic Mathematics that is used to decompose a rational function into simpler fractions, known as partial fractions. The rule is named after the ancient Indian mathematician Parvartya, who is believed to have discovered this method.

The Parvartya rule is a useful tool in calculus and other branches of mathematics, as it enables us to simplify complex rational functions and make them easier to integrate or manipulate.

The basic idea behind the Parvartya rule is to write a rational function as a sum of simpler fractions, each with a different denominator. These fractions can then be combined and simplified to obtain the partial fraction decomposition of the original function.

The Parvartya rule is based on the fundamental theorem of algebra, which states that any polynomial equation of degree n has exactly n roots, real or complex. Using this theorem, we can factorize the denominator of a rational function into a product of irreducible polynomials, each of which corresponds to a different root of the equation.

Once the denominator has been factorized, we can write the rational function as a sum of partial fractions, each with a denominator corresponding to one of the irreducible polynomials.

The coefficients of these partial fractions can be determined by solving a system of linear equations, obtained by equating the coefficients of like terms on both sides of the equation.

The Parvartya rule can be applied to a wide range of rational functions, and is a powerful tool in calculus and other areas of mathematics. It is also a key concept in the study of complex analysis and is used to evaluate complex integrals.

Parvartya rule:

The steps to apply the Parvartya rule in partial fractions are as follows:

Write the rational function as a fraction.

(a).Factorize the denominator of the fraction.

(b) Write down the partial fraction decomposition using the coefficients of the factors of the denominator.

(c) Multiply each partial fraction by the factor that is not present in its denominator.

(d) Add the partial fractions together.

The Parvartya rule involves "crisscrossing" the factors of the denominator to obtain the coefficients of the partial fractions. It can be helpful in simplifying the process of finding the partial fraction decomposition of a rational function.

**Methodology**

We shall first explain the currrent method for making partial fraction and, along-side of it we shall demonstrate the “paravartya” sutra application to.

**Example 1**

Express $\frac{3x+4}{x^2-5x+6}$ into partial fractions.

The current method is as follows

$$\frac{3x+4}{x^2-5x+6}=\frac{3x+4}{(x-2)(x-3)}$$

$$3x+4=A(x-3)+B(x-2) \qquad B$$

$$3x+4=(A+B)x-3A-2B$$

Equating the coefficients of like powers on both sides.

$$A+B=3$$

$$-3A-2B=4$$

Solving these three simultaneous equations involving three unknowns, we have

$$A=-10, B=13,$$

So, $E=\frac{-10}{(x-2)}+\frac{13}{(x-3)}$

In vedic system for getting the value of $A$,

(a) We equate its denominator to zero and thus get the paravartya value of $x$ (i.e. $2$);

(b) And we mentally substitute this value $1$ in the $E$, but without the factor which is $A$'s denominator on the R.H.S.; and

(c) We put this result down as the value of . similarly for $B$.

Thus,

$$A = \frac{3x+4}{(x-3)} = \frac{3*2+4}{2-3} = -10$$

$$B = \frac{3x+4}{(x-2)} = \frac{3*3+4}{3-2} = 13$$

So

$$E = \frac{-10}{(x-2)} + \frac{13}{(x-3)}$$

**Example 2**

Express $\dfrac{3x^2+2}{(x-1)(x-2)(x-3)}$ into partial fractions.

The current method is as follows

$$\frac{3x^2+2}{(x-1)(x-2)(x-3)} = \frac{A}{(x-1)} + \frac{B}{(x-2)} + \frac{C}{(x-3)}$$

$$3x^2+2 = A(x-2)(x-3) + B(x-1)(x-3) + C(x-1)(x-2)$$

$$3x^2+2 = (A+B+C)x^2 + (-5A-4B-3C)x + 6A+3B+2C$$

Equating the coefficients of like powers on both sides.

$$A+B+C=3$$

$$5A+4B+3C=0$$

$$6A+3B+2C=2$$

Solving these three simultaneous equations involving three unknowns we have

$$A = \frac{5}{2}, B = -14, C = \frac{29}{2}$$

So

$$E = \frac{5/2}{(x-1)} - \frac{14}{(x-2)} + \frac{29/2}{(x-3)}$$

In vedic system for getting the value of $A$,

(a)We equate its denominator to zero and thus get the paravartya value of $x$ (i.e. $1$).

(b) And we mentally substitute this value $1$ in the E, but without the factor which is $A$'s denominator on the R.H.S.; and (c)We put this result down as the value of $A$. similarly for $B$.

Thus,

$$A=\frac{3x^2+2}{(x-2)(x-3)}=\frac{3(1)^2+2}{(1-2)(1-3)}=\frac{5}{2}$$

$$B=\frac{3x^2+2}{(x-1)(x-3)}=\frac{3(1)^2+2}{(2-1)(2-3)}=-14$$

$$C=\frac{3x^2+2}{(x-1)(x-3)}=\frac{3(1)^2+2}{(3-1)(3-2)}=\frac{29}{2}$$

So,

$$E=\frac{5/2}{(x-1)}-\frac{14}{(x-2)}+\frac{29/2}{(x-3)}$$

**Conclusion**

The Parvartya rule in Vedic Mathematics is a powerful technique for decomposing a rational function into simpler fractions, known as partial fractions. In recent years, there has been renewed interest in this ancient method, and several new research papers have been published on its theoretical foundations and practical applications.

One such recent research paper focuses on the abstract Parvartya rule, which is a generalization of the traditional method that can be applied to a wider range of rational functions. The paper presents a detailed algorithmic procedure for applying the abstract Parvartya rule and provides several examples of its application to real-world problems.

The authors argue that the Parvartya rule is not just a computational tool, but also a fundamental concept that sheds light on the deep connections between different areas of mathematics.

Overall, the paper makes a valuable contribution to the ongoing research on the Parvartya rule and demonstrates its continued relevance and importance in modern mathematics. By providing a new algorithmic procedure and exploring its theoretical foundations, the paper opens up new avenues for research and applications of this ancient technique.

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