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Use of Vedic mathematics in multiplication and division of Algebraic expressions

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Abstract

Vedic math simplifies complex math for students. These simple Vedic math practises may help students enhance their arithmetic abilities, problem-solving, and confidence. Vedic math supports mental calculations rather than calculators or written methods, which may improve speed and accuracy. Vedic math is useful in engineering, finance, and computer science, where correct calculation is essential. Vedic mathematics offers several algebraic expression multiplication and division methods. We demonstrated with examples that Vedic multiplication and division are more rapid and effective than conventional multiplication and division.

Keywords – Vedic mathematics, multiplication, division.

Introduction -Vedic mathematics is a mathematical system that originated in ancient India and is based on the Vedas, a collection of sacred Hindu books. The Vedic math system is a one-of-a-kind and efficient method to mathematics that simplifies complicated mathematical operations via the use of basic and easy-to-learn approaches. Swami Bharati Krishna Tirtha introduced Vedic math concepts in the early twentieth century. These strategies are based on 16 sutras (aphorisms) and 13 sub-sutras (corollaries), which give a set of rules for swiftly and correctly solving mathematical problems [1]. Vedic math is significant because of its capacity to reduce difficult mathematical operations and make them more approachable to students. Vedic math may help students improve their mathematical skills, problem-solving ability, and confidence in the subject by teaching them these easy strategies. Another significant feature of Vedic mathematics is its reliance on mental calculation. Vedic math encourages learners to complete calculations mentally rather than through calculators or written procedures, which may enhance their speed and accuracy. Moreover, Vedic math has practical applications in sectors such as engineering, economics, and computer science, where accurate computation techniques are critical.

Vedic mathematics provides many techniques for multiplication and division of algebraic expressions [2]. In the present study we have shown with examples that Vedic multiplication and division are faster and more efficient as these involve fewer steps than traditional multiplication and division.

Multiplication and Division using Vedic Mathematics

The multiplication of polynomials in Vedic Mathematics can be done by using Urdhva Tiryagbhyam Sutra. There are three categories for this.

1. Multiplication of Binomials.
2. Multiplication of polynomials with an equal number of terms.
3. Multiplication of polynomials with an unequal number of terms.

1. Multiplication of Binomials

Binomial Expression contains either both terms as Variables or one variable with a constant.

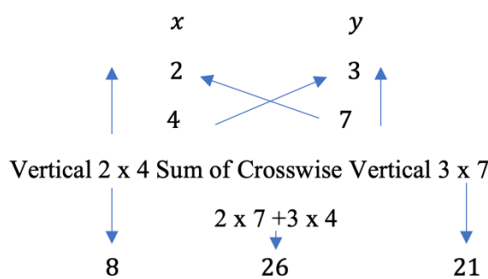
In conventional Method, the multiplication of two binomials can be written as

$$\begin{array}{r} 2x + 3y \\ \times 4x + 7y \\ \hline 4x(2x + 3y) + 7y(2x + 3y) \end{array}$$

(Distributive law)

$$\begin{aligned} &= 8x^2 + 12xy + 14xy + 21y^2 \\ &= 8x^2 + 26xy + 21y^2 \end{aligned}$$

The method adopted in Vedic Mathematics is to write the two variables first, on the top and put the coefficients from each equation below, then apply Urdhya Tiryagbhyam vedic sutra



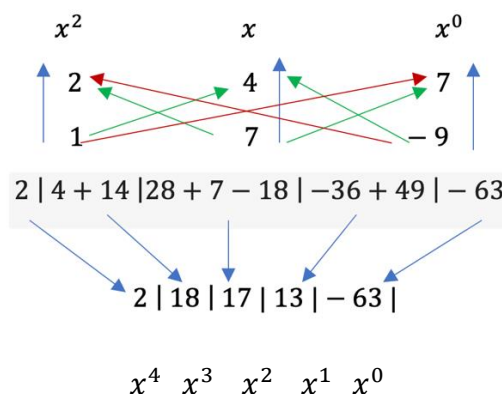
First column is the coefficient of x^2 , second column is the coefficient of xy and the third one is of y^2 ; therefore the answer is $8x^2 + 26xy + 21y^2$

2. Multiplication of polynomials with an equal number of terms.

Considering two trinomials, the same sutra of Vedic Mathematics will apply.

- (i) Write the variables on top and their coefficients below the respective variables.
- (ii) Perform vertical and Crosswise multiplication of the coefficients.
- (iii) Add the variables to the coefficients in their respective order.

Example- $(2x^2 + 4x + 7) \times (x^2 + 7x - 9)$

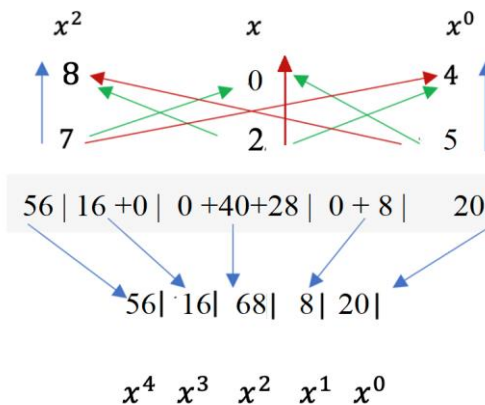


Hence, the solution will be $2x^4 + 18x^3 + 17x^2 + 13x - 63$

3. Multiplication of polynomials with an unequal number of terms

The rule will be same, but we simply write coefficient of missing term as 0

Example $(8x^2 + 4) \times (7x^2 + 2x + 5)$



Hence, the solution will be $56x^4 + 16x^3 + 68x^2 + 8x + 20$

Division of Polynomials-

Consider the example- $x^3 - 3x^2 - 10x + 24$ when divided by $(x - 4)$

$$\begin{array}{r}
 x^2 + x - 6 \\
 x - 4 \overline{) x^3 - 3x^2 - 10x + 24} \\
 \underline{-x^3 + 4x^2} \\
 x^2 - 10x \\
 \underline{-x^2 + 4x} \\
 -6x + 24 \\
 \underline{-6x + 24} \\
 0
 \end{array}$$

Therefore, the quotient is x^2+x-6 and remainder is 0.

In conventional method dividing a polynomial is a long process, but using Vedic Sutras like Paravartya Yojayet and Nikhilam method, division of polynomials is very simple and easy.

Vedic Mathematics Rule-

- (i) First put the divisor as equal to zero. Put it in the first column.
- (ii) Write the dividend in descending order of power. Now write the coefficients of the algebraic expression in second column.
- (iii) Carry down the first number of dividends.
- (iv) Multiply the divisor with this number and write the product below to the next coefficient of dividend, add these two numbers.
- (v) Again, multiply the divisor with this new number (after addition) and write to the below the next coefficient of dividend. Again, add these two numbers. The result will be multiplied by divisor and write to below next coefficient. Again, add and that will be remainder. The division is complete.

Taking the same example $(x^3-3x^2-10x+24) \div (x-4)$

Here, divisor is $x-4$, equating it to zero gives $x=4$.

$$\begin{array}{r|rrrr}
 4 & 1 & -3 & -10 & 24 \\
 & \downarrow & \downarrow & \downarrow & \downarrow \\
 & 1 & 1 & -6 & 0 \\
 \hline
 & & & & \text{Remainder} \\
 & x^2 & x & x^0 &
 \end{array}$$

Therefore, quotient will be $x^2 + x - 6$ when $x^3-3x^2-10x+24$ is divided by $(x-4)$.

This method is very simple as there no subtraction and multiplication of powers of variables.

Another Example $2x^3-5x^2+3x+4 \div (x-2)$

Here, divisor is $x-2$, equating it to zero gives $x=2$.

$$\begin{array}{r|rrrr}
 2 & 2 & -5 & 3 & 7 \\
 & \downarrow & \downarrow & \downarrow & \downarrow \\
 & 2 & -1 & 1 & 9 \\
 \hline
 & & & & \text{Remainder} \\
 & x^2 & x & x^0 &
 \end{array}$$

Therefore, Quotient is $2x^2-x+1$ and Remainder is 9

Conclusions- The present work clearly shows that Vedic mathematics provides a unique approach to algebraic expression multiplication and division, and can be a useful tool for students looking to improve their math skills. The significance of Vedic math stems from its capacity to give a distinct and efficient approach to mathematics that may assist students in improving their abilities, boosting their confidence, and preparing them for success in their academic and professional endeavours.

References-

- [1] Vedic Mathematics by Jagadguru Swami Sri Bharti Krishna Tirtha ji Maharaj, 1965, Motilal Banarasidas, New Delhi, 1986.
- [2] Rajesh Kumar Thakur, Advanced Vedic Mathematics, 2019.