APPLICATIONS OF VEDIC SŪTRAS TO MATHEMATICAL PROBLEMS

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Abstract:

Vedic Mathematics deals mainly with various formulae and their applications for carrying out tedious and cumbersome arithmetical operations and executing them mentally. The aim of this article is to bring this long hidden treasure- trove of mathematical knowledge within every reach of everyone who wishes to obtain it and benefit by it, by illustrating the simplicity of Vedic method and try to encourage a young mind for learning mathematics.

Keywords: Ādyam Sūtra, Lopana-Sthāpana Sūtra, Parāvartya

Introduction:

The vedhas are well known as four in number namely Rig, Yajur, Sama and Atharva but they also have the four Upavedas and six Vedhangas.The four Upavedas are Ayurveda, Gandharva vedha, Dhanur vedha, Sthāpatya vedha.

In his list, the upaveda of Sthāpatya or engineering comprises all kinds of architectural and structural human endeavour and all visual arts. There are sixteen sūtras on which the present one is a part of Parisista of the Atharvaveda.

The sutras apply to cover every branch of mathematics including arithmetic, algebra, geometry (plane and solid), trigonometry(plane and spherical), conics, astronomy, calculus, etc. In fact there is no part of mathematics which is beyond their jurisdiction. The sūtras are easy to understand, to apply and to remember and the whole work can be summarized in one word “mental”.

A practical application in compound multiplication

1. Suppose we want to know the area of a rectangular piece of land whose length and breadth are 7’8’’ and 5’11’’ respectively.

Conventional method

Area = (92/12)* (71/12) = (6532/144) = (1633/36)

```
36)1633(45
     144
      ___
      193
      180
     ___
       13
      X144
     ______
   36)1872(52
      180
     ____
        72
        72
```

_____

Vedic method

We make use of algebraical multiplication and the Ādyam Sūtra and say:
Area = 5x + 11 = $35x^2$ +117x + 88 x 7x + 8
Splitting the middle term (by dividing by 12) we get 9 and 9 as Quotient and Reminder.

E= $35x^2$ + (9x12+9)x + 88
= $44x^2$ +(9x12) +88
= 44 sq.ft + 196 Sq. Inches
= 45 sq.ft + 52 inches square
and the whole work can be done mentally

2. Similarly, 3’7’’ x 5’10’’ = 3’7’’ x 5’10’’
   = $15x^2$ + (35+30) x + 70
   = $15x^2$ + 65x + 70
   = $15x^2$ + (5x12+5) +70
   = $20x^2$ + 130
   = 20 Sq.ft + 130 Sq. Inches

   Also 7’11’’ x 5’11’’ = 7’11’’ x 5’8’’
   = $35x^2$ + (55+56)x + 88
   = $35x^2$ + 111x + 88
   = $35x^2$+ (9x12+3)x + 88
   = $44x^2$ + 36+88
   = 44 Sq.ft + 124 Sq. Inches.

Calculation of Highest Common Factor (HCF)

1. Suppose we want to find the HCF of x^2 +7x+6 and x^2 -5x -6
   x^2 +7x+6 = x^2 + 6x + x+ 6 = x(x+6) + 1(x+6) = (x+6) (x+1)
   x^2-6=5x-6 = x^2 – 6x + x-6 = x(x-6) + 1(x-6) = (x-6) (x+1)
   HCF = x+1

Vedic Method:

Here we apply ‘Lopana-Sthāpana’ sūtra (i.e)Elimination and Retention or alternate destruction of the highest and lowest powers

Explanation:

Let E1 and E2 be two expressions. Then, for destroying the highest powers, we should subtract E2 from E1, and for destroying the lowest one, we should add the two

x^2 +7x+6 } Subtraction
x^2- 5x - 6 }
÷ by 12 w get x+1

x^2 -5x-6 } Addition
x^2 +7x+6 }
÷ by 2x we get x+1

x + 1 is the HCF

2. Find the HFC of $x^3 - 3x^2$ -4x+12 and x^3 -$7x^2$ +16x – 12

Conventional method

Consider x^3-$3x^2$-4x +12

x -2 is a factor

x^3 -$3x^2$-4x+12 = (x-2)(x^2-x-6)

= (x-2) (x^2-3x+2x-6)

= (x-2)(x(x-3)+2(x-3))

= (x-2)(x-3)(x+2)

Consider $x^3 - 7x^2$+16x-12

x-2 is a factor

$x^3 - 7x^2$+16x-12 = (x-2)(x2-5x+6)

= (x-2)(x^2-3x-2x+6)

= (x-2)x(x-3)-2(x3)

= ((x-2)(x-3)(x-2)

HCF = (x-2)(x-3) = x^2 -5x +6

By Lopana-Sthāpana method

x^3-$3x^2$-4x+12	x^3-$7x^2$+16x-12
-(x^3-$7x^2$+16x-12)	+ x^3-$3x^2$-4x+12
$4x^2$-20x+24	$2x^3$ -$10x^2$+12x
÷ by 4, x^2-5x +6	÷by 2x, x^2 -5x+6

HCF = x^2-5x+6

3) Solving simple equations:

To solve simple equations,Vedic method enables us to perform the necessary operation by mere application .The underlying principle is Parāvartya Yojayet which means "Transpose and Adjust"

i) Solve 2x +7 = x+9

Conventional method:

2 x- x = 9 -7

X = 2

Vedic method

If 2x +7 = x+9, then

x = (9-7)/(2-1) = 2/1 = 2

Logics:

1) If ax +b = cx+d,

then ,x=(d-b)/(a-c)

2)If (x+a)(x+b) = (x+c)(x+d),

then x = (cd-ab)/(a+b-c-d)

(eg)If (x+7)(x+9) = (x+3)(x+21),

then x=(63-63)/(7+9 -3-21) = 0/-8 = 0

3. If (ax+b)/(cx+d) = p/q , then x = (pd-bq)/(aq-cp)

4. If (m/(x+a))+ (n/(x+b) = 0, then x = (mb-na)/(m+n)

Conclusion: Vedic Mathematics unfolds a new method of approach. The formulae from Vedas are very interesting and provoke reader's interest by all means of possibilities

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