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The Implementation of Vedic Mathematics toAlgebra and Geometry

[1]M.N.Dhanave,[2]M.A.Kangale
[1,2]Lecturer,Brahmdevdada Mane Institute of Technology, Solapur,Maharashtra.

Abstract: *Vedic mathematics is the name given to the ancient Indian system of mathematics that was rediscovered in early twentieth century. Vedic mathematics is mainly based on sixteen principles or word-formulae which are termed as sutras. We discuss possible application of Vedic mathematics to branches of mathematics i.e. algebra and geometry. In this paper, after a gentle introduction of these sutras, it is applied to algebra and geometry problems. Vedic maths appears, at first, to have magical quality. When methods are understood, particularly in relation to one another, then it is unified mathematics.*
Keywords-

I. Introduction

Mathematics is practical science as it helps us with the daily life.It also helps us to understand the mysteries of universe.

The study of mathematics may be seen as having two directions,an outer and an inner. The outer direction moves us to applying number, order and mathematical relationships in world around us. It is practical, useful & beneficial.

The other direction in mathematics is an inner one. It takes us back to the very foundation blocks upon which the subject stands. Ultimately, it reminds us of our origin, the unity, supreme self, which is the basis of entire creation.

So,these are two directions but they are not exclusive. It is more the case that inner direction enhances the understanding of outer direction. It is the Vedic system,that enables these two directions to be studied in mutual harmony and this may be accomplished through correct appreciation of the sutras. Vedic mathematics is mainly based on 16 Sutras (or aphorisms) dealing with various branches of mathematics like arithmetic, algebra, geometry, etc. These Sutras along with their brief meanings are enlisted below alphabetically.

1. (Anurupye) Shunyamanyat – If one is in ratio, the other is zero.
2. Chalana-Kalanabyham – Differences and Similarities.
3. EkadhikinaPurvena – By one more than the previous One.
4. EkanyunenaPurvena – By one less than the previous one.
5. Gunakasamuchyah – The factors of the sum is equal to the sum of the factors.
6. Gunitasamuchyah – The product of the sum is equal to the sum of the product.
7. NikhilamNavatashcaramamDashatah – All from 9 and last from 10.
8. ParaavartyaYojayet – Transpose and adjust.
9. Puranapuranabyham – By the completion or noncompletion.
10. Sankalana- vyavakalanabhyam – By addition and by subtraction.
11. ShesanyankenaCharamena – The remainders by the last digit.
12. ShunyamSaamyasamuccaye – When the sum is the same that sum is zero.
13. Sopaantyadvayamantyam – The ultimate and twice the penultimate.
14. Urdhva-tiryagbhyam – Vertically and crosswise.
15. Vyashtisamanstih – Part and Whole.
16. Yaavadunam – Whatever the extent of its deficiency.

The Vedic methods are direct and truly extraordinary in their efficiency and simplicity. They reflect a long mathematical tradition, which produced many simplifications, Shortcuts and smart tricks. Arithmetic computations cannot be obtained faster by any other known method. This paper describes the different techniques used in ancient Vedic mathematics for problems in algebra and geometry.These methods and ideas can be directly applied to trigonometry, plain and spherical geometry, conics, calculus (both differential and integral) and applied mathematics of different kinds.

II. Implementation of Vedic Mathematics in algebra

Example 1- A Simple idea for factorization of polynomial expression of two or more variables is rooted in **AdyamadyenaSutra**i.e.the first by the first and the last by the last. This sutra is based on the fact that the product of two numbers in first situation is equal to the product of two numbers in second situation.
Let us consider, for example, the polynomial
$P(x,y,z) = 3x^2+4y^2+3z^2+8xy+10xz+8yz$Which can be factorized by setting $z=0$

$P(x,y, 0) = 3x^2 +4y^2 +3z^2+8xy$
$= (-3x + 2y) (x +2y)$ ---------------*1*

And next $y=0$

$P(x, 0, z) = 3x^2 +3z^2+10xz$
$= (3x+z) (x+3z)$ --------------- *2*

By comparing the obtained factorization in equation *1, 2* and completing each factor with additional terms from other factorization. We obtain factorization of $P (x, y, z)$ as

$P(x, y, z)= (3x +2y+z) (x + 2y + 3z)$ ------------ *3*

Also notice that on substituting $x =0$,
$P (0, y, z) = 4y^2 + 3z^2 + 8yz$
$= (2y + z) (2y + 3z)$
inaccordance with factorization in *3*.

Example 2 – It is also possible to eliminate two variables at a time.
For example, consider the polynomial,
$Q (x, y, z) = 3x^2 +4y^2 +3z^2+8xy +10xz + 8yz + 20x + 16y + 12z +12$
Such eliminationslead to,

$Q (x, 0, 0) = 3x^2 + 20x +12 = (x+6) (3x+2)$

$Q (0, y, 0) = 4y^2 +16y +12 = (2y+6) (2y+2)$

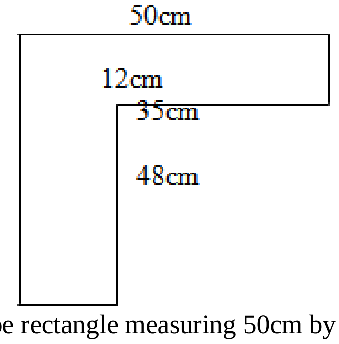
$Q (0, 0, z) = 3z^2 + 12 z +12 = (3z+6) (z+2)$

Using completion method similar to example 1,we get

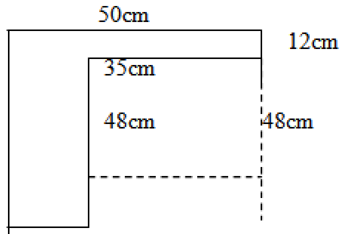
$Q (x, y, z) = (x + 2y + 3z + 6) (3x + 2y + z + 2)$

Implementation of Vedic mathematics to Geometry

Example 1:- The problem is to find the area of the shape given below. It can be done either by subtraction, or by addition. Both methods are shown below. It can be done either by subtraction or by addition. Both methods are shown below.

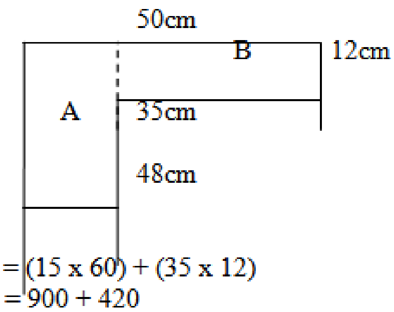


I.By Subtraction, consider the shape to be rectangle measuring 50cm by 60cm out of which another rectangle measuring 35cm by 48 cm has been removed.



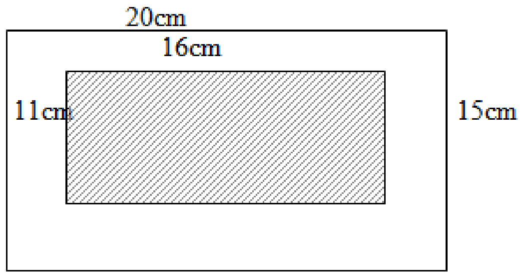
Then,
Area = (50 X 60 - (35 X 48)
= 3000 - 1680
= 1320cm^2

II. By addition, the shape is partitioned in to two rectangles A &B,where A is 15cm by 60cm and B is 35 cm by 12cm. Then



Area = (15 x 60) + (35 x 12)
= 900 + 420
= 1320cm^2

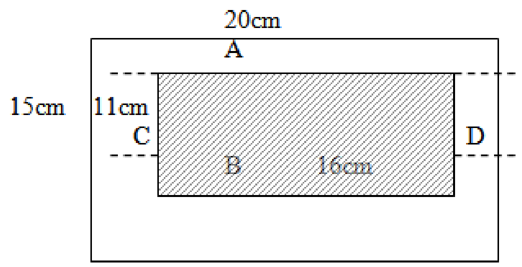
Example 2 – The shaded rectangle is 11 cm by 16cm. Find area of border.



I. By subtraction consider from the rectangle measuring 20cm by 15cm the rectangle measuring 16cm by 11 cm is to be removed.

Area = (20 x 15) – (16 x 11)
= 300 – 176
= 124 cm^2

II. By addition the border is partitioned in to rectangles A,B,C,D where A & B are 20 By 2cm and c& d are 11 cm by 2cm.



Then, Area = (20 x 2) + (20 x 2) + (11 x 2)+(11 x 2)
= 40 + 40 + 22 + 22
= 80 + 44
= 124 cm^2

III. Conclusion

Vedic Mathematical methods are derived from ancient systems of computations, now available to everyone through the great work of Jagadguru Swami SriBharati Krishna TirthajiMaharaja,who published book on Vedic mathematics in 1965. Compared to conventional mathematical methods,these are computationally faster and easy to perform.

In the research work results in guiding maxims that the whole of mathematics is governed by 16 Sutra's which are both objective and subjective in there character. They are objective in that they may be applied to solve every day problems place in mind at time that a problem is being solved.The subjective object is that a Sutra may also describe that the way human mind naturally works.The whole emphasis of system is on process and movement taking.

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