The Vedic? Mathematics-

-Sutras 9 to 12

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Introduction:

The work Vedic Mathematics consisting of sixteen sutras or formulas was authored by Jagadguru Sankaracarya Sri Bharati Krsna Tirthaji Maharaj of Govardhana Matha, Puri (1884-1960). Dr. V.S. Agrawala, General Editor, Hindu Vishvavidyalaya, Nepal Rajya Sanskrit Granthamala Series, had stated that, *It forms a class by itself not pragmatically conceived and worked out as in the case of other scientific works, but is the result of the intutional visualisation of fundamental mathematical truths and principles during the course of eight years of highly concentrated mental endeavour on the part of the author... .*

Tirthaji's Vedic Mathematics deals mainly with various Vedic mathematical formulas and their applications for carrying out tedious and cumbersome arithmetical operations, and to a large extent, executing them mentally. [1]

The sutras (9 to 12):

9)CALANA KALANĀ BHYĀ M Sequential Motion

In the book on Vedic Mathematics Sri Bharati Krishna Tirthaji mentioned the Sutra 'Calana - Kalanabhyam' at only two places.

i)In the first instance it is used to find the roots of quadratic equations. Swamiji called the sutra as calculus formula. The exact statement of the sutra could not be located in the book, if it is at all there. However by using the 'principle rules' of calculus Tirthaji has shown how to find out roots of quadratic equations. According to the book the principle rules are-

a) In every quadratic expression put in it's standard form, i.e. with coefficient of x^2 = 1, the sum of it's two binomial factors is its first differential.

b)The first differential of each term can be found out but multiplying its Dhvaja Ghata i.e. the power with the Anka or coefficient.

c)The discriminant is defined as the square of the coefficient of the middle term minus the product of double the first coefficient and double the independent term. Also it is stated that the first differential is equal to the square root of the discriminant.

ii)At the Second instance under the chapter Factorization and Differential Calculus for factorizing expressions of 3rd, 4th and 5th degree, the procedure is mentioned as 'Vedic Sutras relating to Calana Kalana Differential Calculus', which was said to be dealt later on but unfortunately I failed to locate any mention of the sutra anywhere else.

10)YĀVADŪNAM

Yāvadūnam Sutra (for cubing) is the tenth sutra. The Yavadunam Sutra for squaring has also been mentioned but the steps for applying the sutra could not be located. Regarding cubing Tirthaji, has given a few examples.

E.g. To find out the cube of say 104, we take the base 100 and add double of the excess i.e. 8 to the number to get 104+8(= 112) as the left most portion of the cube. Then we put the new excess multiplied by the original excess (i.e. 12*4 =48) and put that as the middle portion of the product. The cube of the original excess i.e. 64 is then affixed as the last portion of the product. So the final result is 1124864 .

It has a subsutra called Samuccayagunitah which is incidentally also a subsutra of the thirteenth sutra Sopantyadvayanamtyam.

11)VYASTISAMASTIH

Vyastisamastih sutra teaches one how to use the average or exact middle binomial for breaking the bi quadratic down into a simple quadratic by the easy device of mutual cancellations of

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the odd powers. However the modus operandi is missing.

12)ŚESANYANKENA CARAMENA

The sutra Śesānyankena Caramena means The remainders bythe last digit . For instance if one wants to find decimal value of 1/7. The remainders are 3, 2, 6, 4, 5 and 1. Multiplied by 7 these remainders give successively 21, 14, 42, 28, 35 and 7. Ignoring the left hand side digits we simply put down the last digit of each product and we get 1/7 = .14 28 57!

Now this 12th sutra has a subsutra Vilokanam. Vilokanam means mere observation He has given a few trivial examples for the same.

x+y=5

xy=6

By applying Vilokanam subsutra Tirthaji finds out x =2, y=3 or x=3,y=2 .

Criticism of Tirthaji's Vedic Mathematics:

The pertinent question raised by critics is whether the Sutras upon which the treatise is based has any connection with the Vedas or Vedic literature.

According to Dr. V.S. Agrawala, *It is the whole essence of his assessment of Vedic tradition that it is not to be approached from a factual standpoint but from the ideal standpoint viz., as the Vedas, as traditionally accepted in India as the repository of all knowledge, should be and not what they are in human possession. That approach entirely turns the table on all critics, for the authorship of Vedic mathematics need not be laboriously searched for in the texts as preserved from antiquity. [&]In the light of the above definition and approach must be understood the author s statement that the sixteen sutras on which the present volume is based form part of a Parisista of the Atharvaveda. We are aware that each Veda has its subsidiary apocryphal text, some of which remain in manuscripts and others have been printed but that formulation has not closed. For example, some Parisista of the Atharvaveda were edited by G.M.Bolling and J. Von Negelein, Leipzig,1909-10. But this work of Sri Sankaracharyaji deserves to be regarded as a new Parisista by itself and it is not surprising that the Sutras mentioned herein do not appear in the hitherto known Parisistas. A list of these main 16 Sutras and of their sub-sutras or corollaries is prefixed in the beginning of the text and the style of language also points to their discovery by Sri Swamiji himself. At any rate, it is needless to dwell longer on this point of origin since the vast merit of these rules should be a matter of discovery for each intelligent reader. Whatever is written here by the author stands on its own merits and is presented as such to the mathematical world.*

But this doesn't really resolve the question regarding the source of so called Vedic Mathematics . In strict sense the term Vedic should be restricted to materials obtained from the Vedas or at most to materials that can be logically inferred to be pertaining to the Vedic Civilisation. One of the things that was noticeable that while discussing about the sutras, Tirthaji did not make any claim about the origin of the sutras, he just mentioned them wherever it was necessary to memorise some point. It is in the prefatory notes that these claims have been raised with great hue and cry.

Another point raised by critics pertains to the sutra's themselves. The sutras by themselves are highly vague and ambiguous in their meaning and given sufficient amount of freedom of interpretation one can use them to describe a wide variety of stuffs. *One of them, for instance, is **Ekadhikena Purvena** which literally just means 'by one more than the previous one'**.** In chapter I, the swamiji tells us that it is a sutra for finding the digits in the decimal expansion of numbers such as 1/19, and 1/29, where the denominator is a number with 9 in the unit s place;... Allowing oneself such unlimited freedom of interpretation, one can also interpret the same three-word phrase to mean also many other things not only in mathematics but also in many other subjects such as physics, chemistry, biology, economics, sociology and politics..... Another sutra is **Yavadunam**, which means 'as much less';a lifetime may not suffice to write down all the things such a phrase could 'mean,' in the spirit as above. There is even a sub-sutra, **Vilokanam** (observation) and that is supposed to mean various mathematical steps involving observation! In the same vein one can actually suggest a single sutra adequate not only for all of mathematics but*

many many subjects: Chintanam (think)! [2] In fact there are quite a few scholars who hold Tirthaji's Vedic Maths responsible for throwing historians off the track and making them overlook the real developments in the field of mathematics made by Indian scholars.

Conclusion:

Contrary to what Vedic Mathematics has been portrayed as, Vedic Maths is by no means a comprehensive mathematical treatise encompassing all branches of mathematics. However it is indeed an assortment clever of tricks based on simple algebraic principles which do speed up mental calculations and arithmetic. They also serve as good memory aids to its practitioners. However the trouble is that these are very problem specific and depend on identifying special features which may be exploited to attack the problems. In this respect Tirthaji's sutras are akin to Trachtenberg's speed mathematics. Putting it up under the garb of Vedic Mathematics just to increase its popular appeal is certainly not desirable. *Indulging in things chiefly on account of their supposed association with our forefathers is a sure prescription for moving backward in history*. [3] *Heritage of Vedas, like other heritages down the ages, is a precious endowment..... We should respect it, propagate it and learn from it in a rational way.* [4]

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