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PREFACE

India has a rich heritage of culture and education. It is one of the most consistently and culturally assorted nations on the earth. India is popular for the most deeply religious societies and cultures. Religion plays a central role in Indian History to till time. Its legends, leaders and people are ultimate role in the life. Culturally, India has always been united in the intelligence that its populace belonging to diverse races, talking varied languages, professing dissimilar faiths and following a assortment of communal ways have every time recognized the primacy of religious and principled principles
in individual's performance.

The writers of this book tried to high-lights on the Indian Traditions, Indian History, various Indian Era, and India before Independent and after Independent. Some writers took major efforts to focus on development in Educational sectors, the special techniques in war used by Indian great legend Raje Shivaji, Indian Scenario of employment and so on. These all articles and papers prove that since ancient era Indian is having good writers too. About India no one can deny the fact that Indians have forever privileged men of peace as, 'Saints, mystics, spiritual teachers, scholars, logician and far-sighted statesmen committed to tranquility and individual welfare, not military heroes or men of prosperity or communal reputation.' Better to conclude with the words of Oliver Wendell Holmes, "Language is the blood of the soul into which thoughts run and out of which they grow."

I wish all the best to all writers who wrote for this book.......................

Dr. Nirmala S. Padmavat

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01

"INTRODUCTION TO VEDIC MATHEMATICS"

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INTRODUCTION:-

Vedic mathematics [1] is the name given to the ancient system ofmathematics, or, to be precise, a unique technique of calculation sbased on simple rules and principles with which any mathematicalproblem can be solved be it arithmetic, algebra, geometry ortrigo nometry. The system is based on 16 Vedic sutras [Table1] oraphorisms, which are actually word formulae describing naturalways of solving a whole range of mathematical problems.Vedic math was rediscovered from the ancient Indian scriptures between 1911 and 1918 by Sri Bharati Krishna Tirthaji (1884-1960), a scholar of Sanskrit, Mathematics, History and Philosophy. He studied these ancient texts for years, and after careful investigation was able to reconstruct a series of mathematical formulae called sutras.

Bharati Krishna Tirthaji, who was also the former Shankaracharya (major religious leader) of Puri, India, delved into the ancient Vedic texts and established the techniques of this system in his pioneering work - Vedic Mathematics (1965), which is considered the starting point for all work on Vedic math. It is said that after Bharati Krishna's original 16 volumes of work expounding the Vedic system were lost, in his final years he wrote this single volume, which was published five years after his death. Development of Vedic MathVedic math was immediately hailed as a new alternative system of mathematics, when a copy of the book reached London in the late 1960s. Some British mathematicians, including Kenneth Williams, Andrew Nicholas and Jeremy Pickles took interest in this new system. They extended the introductory material of Bharati Krishna's book, and delivered lectures on it in London. In 1981, this was collated into a book entitled Introductory Lectures on Vedic Mathematics. A few successive trips to India by Andrew Nicholas between 1981 and 1987, renewed the interest on Vedic math, and scholars and teachers in India started taking it seriously. The Growing Popularity of Vedic MathInterest in Vedic maths is growing in the field of education where maths teachers are looking for a new and better approach to the subject. Even students at the Indian Institute of Technology (IIT) are said to be using this ancient technique for quick calculations. No wonder, a recent Convocation speech addressed to the students of IIT, Delhi, by Dr. Murli Manohar Joshi, Indian Minister for Science & Technology, stressed the significance of Vedic maths, while pointing out the important contributions of ancient Indian mathematicians, such as Aryabhatta, who laid the foundations of algebra, Baudhayan, the great geometer, and Medhatithi and Madhyatithi, the saint duo, who formulated the basic framework for numerals.

Vedic Maths in Schools:

Quite a few years ago, St James' School, London, and other schools began to teach the Vedic system, with notable success. Today this remarkable system is taught in many schools and institutes in India and abroad, and even to MBA and economics students.When in 1988, Maharishi Mahesh Yogi brought to light the marvels of Vedic maths, Maharishi Schools around the world incorporated it in their syllabi. At the school in Skelmersdale, Lancashire, UK, a full course called "The Cosmic Computer" was written and tested on 11 to 14 year old pupils,

and later published in 1998. According to Mahesh Yogi, "The sutras of Vedic Mathematics are the software for the cosmic computer that runs this universe."

Since 1999, a Delhi-based forum called International Research Foundation for Vedic Mathematics and Indian Heritage, which promotes value-based education, has been organizing lectures on Vedic maths in various schools in Delhi, including Cambridge School, Amity International, DAV Public School, and Tagore International School.

Vedic Math Research:

Researchers are being undertaken in many areas, including the effects of learning Vedic maths on children. A great deal of research is also being done on how to develop more powerful and easy applications of the Vedic sutras in geometry, calculus, and computing. The Vedic Mathematics Research Group published three new books in 1984, the year of the centenary of the birth of Sri Bharati Krishna Tirthaji.

There are obviously many advantages of using a flexible, refined and efficient mental system like Vedic math. Pupils can come out of the confinement of the 'only one correct' way, and make their own methods under the Vedic system. Thus, it can induce creativity in intelligent pupils, while helping slow-learners grasp the basic concepts of mathematics. A wider use of Vedic math can undoubtedly generate interest in a subject that is generally dreaded by children.

2. VEDIC MATHS HISTORY:

2.1. What is Vedic Mathematics?(History, Features and Background)

Vedic Mathematics is the name given to the ancient system of Indian Mathematics which was rediscovered from the Vedas between 1911 and 1918 by Sri Bharati Krsna Tirthaji (1884-1960). According to his research all of mathematics is based on sixteen Sutras, or word-formulae. For example, vertically and crosswise is one of these Sutras. These formulae describe the way the mind naturally works and are therefore a great help in directing the student to the appropriate method of solution. Perhaps the most striking feature of the Vedic system is its coherence. Instead of ahotchpotch of unrelated techniques the whole system is beautifully interrelated and unified: the general multiplication method, for example, is easily reversed to allow one-line divisions and the simple squaring method can be reversed to give one-line square roots. And these are all easily understood. This unifying quality is very satisfying; it makes mathematics easy and enjoyable and encourages innovation. In the Vedic system 'difficult' problems or huge sums can often be solved immediately by the Vedic method. These striking and beautiful methods are just a part of a complete system of mathematics which is far more systematic than the modern 'system'. Vedic Mathematics manifests the coherent and unified structure of mathematics and the methods are complementary, direct and easy. The simplicity of Vedic Mathematics means that calculations can be carried out mentally (though the methods can also be written down). There are many advantages in using a flexible, mental system. Pupils can invent their own methods, they are not limited to the one 'correct' method. This leads to more creative, interested and intelligent pupils. Interest in the Vedic system is growing in education where mathematics teachers are looking for something better and finding the Vedic system is the answer. Research is being carried out in many areas including the effects of learning Vedic Maths on children; developing new, powerful but easy applications of the Vedic Sutras in geometry, calculus, computing etc.But the real beauty and effectiveness of Vedic Mathematics cannot be fully appreciated without actually practising the system. One can then see that it is perhaps the most refined and efficient mathematical system possible.

2.1.1 Sutras:

The Vedic Mathematics Sutras this list of sutras is taken from the book Vedic Mathematics, which includes a full list of the sixteen Sutras in Sanskrit, but in some cases a translation of the Sanskrit is not given in the

Sl. No	Sutras	Sub sutras or Corollaries
1.	Ekādhikena Pūrvena (also a corollary)	Ānurūpyena
2.	Nikhilam Navataścaramam Daśatah	Śisyate Śesamjnah
3.	Ūrdhva - tiryagbhyām	Ādyamādyenantyamantyena
4.	Parāvartya Yojayet	Kevalaih Saptakam Gunyat
5.	Śūnyam Samyasamuccaye	Vestanam
6.	(Ānurūpye) Śūnyamanyat	Yāvadūnam Tāvadūnam
7.	Sankalana - vyavakalanābhyām	Yāvadūnam Tāvadūnīkrtya Varganca Yojayet
8.	Puranāpuranābhyām	Antyayordasake' pi
9.	Calanā kalanābhyām	Antyayoreva
10.	Yāvadūnam	Samuccayagunitah
11.	Vyastisamastih	Lopanasthāpanabhyām
12.	Śesānyankena Caramena	Vilokanam
13.	Sopantyadvayamantyam	Gunitasamuccayah Samuccayagunitah
14.	Ekanyūnena Pūrvena	
15.	Gunitasamuccayah	
16.	Gunakasamuccayah	

Note: The current Shankaracharya of Puri, Jagadguru Swami Nishchalananda Saraswati, has said (in 2008) he will be able to locate all the above sutras in the Vedic texts, but has so far only found one. See also the article "The Sutras of Vedic Mathematics", by Kenneth Williams, published in the Journal of the Oriental Institute.

2.2 Features of Vedic Maths:

There are many features of the Vedic system which contrast significantly with conventional mathematics.

2.2.1 Coherence -

Perhaps the most striking feature of the Vedic system is its coherence. Instead of a hotchpotch of unrelated techniques the whole system is beautifully interrelated and unified: the general multiplication method, for example, is easily reversed to allow one-line divisions and the simple squaring method can be reversed to give one-line square roots. And these are all easily understood. This unifying quality is very satisfying, it makes mathematics easy and enjoyable and encourages innovation.

2.2.2 Flexibility-

In modern teaching you usually have one way of doing a calculation. This is rigid and boring, and intelligent and creative students rebel against it. Once you allow variations you get all sorts of benefits. Children become more creative. The teacher is encouraging innovation and the children respond. In the Vedic system there are general methods, that always work, for example a method of multiplication that can be applied to any numbers. But the Vedic system has many special methods, when a calculation has some special characteristic that can be used to find the answer more easily. And it's great fun when you spot that method. Having only one method of, say, multiplying is like a carpenter who uses a screwdriver for every job. The skilled craftsman selects the tool most appropriate for the job and gets it done quicker, better and with more satisfaction.So there are special methods, which apply in special cases, and also general methods. You don't have to use these special methods but they are there if you want to. This flexibility adds to the fun and gives pupils the freedom to choose their own approach. This in turn leads to the development of creativity and intuition. The Vedic system does not insist on a purely analytic approach as many modern teaching methods do. This makes a big difference to the attitude which children have towards mathematics.In this rapidly changing world adaptability and flexibility are absolutely essential for success. For the future we can expect more change and perhaps at a more rapid pace.

2.2.3 Mental, improves memory -

The ease and simplicity of Vedic Mathematics means that calculations can be carried out mentally (though the methods can also be written down). There are many

advantages in using a flexible, mental system. Pupils can invent their own methods; they are not limited to the one 'correct' method. This leads to more creative, interested and intelligent pupils. It also leads to improved memory and greater mental agility. Bear in mind also that mathematical objects are mental objects. In working directly with these objects as in mental maths you get closer to the objects and understand them and their properties and relationships much better. Of course there are times especially early on when physical activities are a great help to understanding.

2.2.4 Promotes creativity -

All these features of Vedic math encourage students to be creative in doing their math. Being naturally creative students like to devise their own methods of solution. The Vedic system seeks to cultivate intuition, having a conscious proof or explanation of a method beforehand is not essential in the Vedic methodology. These appeals to the artistic types who prefer not to use analytical ways of thinking.

2.2.5 Appeals to everyone -

The Vedic system appears to be effective over all ability ranges: the able child loves the choice and freedom to experiment and the less able may prefer to stick to the general methods but loves the simple patterns they can use. Artistic types love the opportunity to invent and have their own unique input, while the analytic types enjoy the challenge and scope of multiple methods.

2.2.6 Increases mental agility -

Because the Vedic system uses these ultra-easy methods mental calculation is preferred and leads naturally to develop mental agility. And this in turn leads to growth in other subjects.

2.2.7 Efficient and fast -

In the Vedic system 'difficult' problems or huge sums can often be solved immediately. These striking and beautiful methods are just a part of a complete system of mathematics which is far more systematic than the modern 'system'. Vedic Mathematics manifests the coherent and unified structure naturally inherent in mathematics and the methods are direct, easy and complementary.

2.2.8 Easy, fun -

The experience of the joy of mathematics is an immediate and natural consequence of practising Vedic Mathematics. And this is the true nature of maths - not the rigid and boring 'system' that is currently widespread.

2.2.9 Methods apply in algebra -

Another important feature of the Vedic system is that once an arithmetic method has been mastered the same method can be applied to algebraic cases of that type - the beautiful coherence between arithmetic and algebra is clearly manifest in the Vedic system.

3.DISCOVERY OF VEDIC MATHS:

Vedic Mathematics is the name given to the ancient system of Indian Mathematics which was rediscovered from the Vedas between 1911 and 1918. This obsession with 'Vedic' results from the fundamentalistHindu organizations need to claim their identity as Aryan (andhence of Caucasian origin) and hence superior to the rest of thenative inhabitants of India. The 'Vedas' are considered 'divine'in origin and are assumed to be direct revelations from God.The whole corpus of Vedic literature is in Sanskrit. The Vedasare four in number: Rgveda, Saamaveda, Yajurveda andAtharvaveda. In traditional Hinduism, the Vedas as a body ofknowledge were to be learnt only by the 'upper' caste Hindusand the 'lower castes' (Sudras) and so-called 'untouchables'(who were outside the Hindu social order) were forbidden from learning or even hearing to their recitation. For severalcenturies, the Vedas were not written down but passed fromgeneration to generation through oral transmission. Whilereligious significance is essential for maintaining Aryansupremacy and the caste system, the claims made about theVedas were of the highest order of hyperbole.

TIRTHAJI ANDTHE REDISCOVERY OF VEDIC MATHEMATICS:

Bharati Krishna TirthajiThe ancient system of Vedic Mathematics was rediscovered from the Indian Sanskrit texts known as the Vedas, between 1911 and 1918 by Sri Bharati Krishna Tirthaji (1884-1960). At the beginning of the twentieth century, when there was a great interest in the Sanskrit texts in Europe, Bharati Krishna tells us some scholars ridiculed certain texts which were headed 'Ganita Sutras'- which means mathematics. They could find no mathematics in the translation and dismissed the texts as rubbish. Bharati Krishna, who was himself a scholar of Sanskrit, Mathematics, History and Philosophy, studied these texts and after lengthy and careful investigation was able to reconstruct the mathematics of the Vedas. According to his research all of mathematics is based on sixteen Sutras, or word-formulae. Bharati Krishna wrote sixteen volumes expounding the Vedic system but these were unaccountably lost and when the loss was confirmed in his final years he wrote a single book: Vedic Mathematics, currently available. It was published in 1965, five years after his death.

The Life of Sri Bharati Krishna Tirthaji

Jagadguru Shankaracharya Swami Bharati Krishna Tirtha (hereafter "Bharati Krishna")

lived from 1884 to 1960. He is said to have reconstructed the ancient system of Vedic Mathematics from certain Sanskrit texts which other scholars had dismissed as nonsense. He tells us that the Vedic system which he rediscovered is based on sixteen Sutras which cover all branches of mathematics, pure and applied. The methods he showed and the simple Sutras on which it is based are extraordinarily simple and easy to apply, and the whole system possesses a unity not found in conventional mathematical methods. It can hardly be doubted that Bharati Krishna's remarkable discoveries in mathematics will in time change the teaching of and approach to mathematics worldwide: but this was not his main interest in life. His life was devoted to helping those individuals he could and also helping to bring about world peace and spiritual renewal. This short article aims to show something of his character and life and is drawn mainly from an introduction by Mrs Manjula Trivedi in the book "Vedic Mathematics" by Bharati Krishna. She looked after Bharati Krishna in the last years of his life and afterwards took charge of the Foundation he set up in Nagpur in 1953- the Sri Vishwapunarniman Sangha.

According to Manjula Trivedi, Bharati Krishna "named as Venkatraman in his early days, was an exceptionally brilliant student and invariably won the first place in all subjects in all the classes throughout his educational career. . . at the age of just twenty he passed M.A. Examination in further seven subjects simultaneously securing the highest honours in all, which is perhaps the all-time record of academic brilliance. His subjects included Sanskrit, Philosophy, English, Mathematics, History and Science". In 1908 he was made first Principal of the newly started National College at Rajmahendri, a post he held for three years.Having a "burning desire for spiritual knowledge, practice and attainment" he then spent many years at the most advanced studies

with the Shankaracharya at Sringeri in Mysore and was given the name Bharati Krishna Tirtha when he was initiated into the order of Samnyasa at Benares in 1919. He later, in 1925, became a Shankaracharya (the highest religious title in India).

Shankaracharya

He believed in the ancient Vedic tradition of all-round spiritual and cultural harmony, and his ambition for humanity was a world-wide cultural and spiritual renewal. People flocked to him in crowds and waited at his doors for hours. Granted an interview with him people felt that he immediately knew their need. Even when suffering from excessive strain he refused to take rest, continuing with his studies, talks, lectures and writings with unabated and youth-like vigour and enthusiasm.In 1958 Bharati Krishna went on a tour to America, addressing audiences in hundreds of colleges, universities, churches and other institutions.This was organised by the Self-Realisation Fellowship.

SRI SHANKARACHARYA AT SRF-YSS HEADQUARTERS
Sri Jagadguru Shankaracharya Bharati Krishna Tirtha of Puri, India, at Self-Realization Fellowship International Headquarters, Los Angeles (founded in 1925 by Paramahansa Yogananda). In 1958, the Jagadguru, senior head of the Swami Order, paid a three-months' visit to America, sponsored by Self-Realization Fellowship. It was the first time in the history of the ancient Swami Order that a Shankaracharya had traveled to the West.

He also gave talks and mathematical demonstrations on television and gave some lectures in the UK on his way back to India, in May 1958.Bharati Krishna wrote sixteen volumes on Vedic Mathematics, one on each Sutra, but the manuscripts were irretrievably lost. He said that he would rewrite them from memory but owing to ill-health and failing eyesight got no further than writing a book intended as an introduction to the sixteen volumes. That book "Vedic Mathematics", written with the aid of an amanuensis, is currently available and is the only surviving work on mathematics by this most remarkable man.

4.SOME PROBLEMS USING VEDIC MATHS :
Example1. Use the formula ALL FROM 9 AND THE LAST FROM 10 to perform instant subtractions.
For example 1000 - 357 = 643

We simply take each figure in 357 from 9 and the last figure from 10.

$$1\ 0\ 0\ 0\ -\ 3\ 5\ 7$$

from 9 from 9 from 10

$$=\ 6\ 4\ 3$$

So the answer is 1000 - 357 = 643

This always works for subtractions from numbers consisting of a 1 followed by noughts: 100; 1000; 10,000 etc.
Similarly 10,000 - 1049 = 8951

$$1\ 0\ ,\ 0\ 0\ 0\ -\ 1\ 0\ 4\ 9$$

from 9 from 9 from 9 from 10

$$=\ 8\ 9\ 5\ 1$$

For 1000 - 83, in which we have more zeros than figures in the numbers being subtracted, we simply suppose 83 is 083.
So 1000 - 83 becomes 1000 - 083 = 917

Example2 TABLES MAGIC

Don't know your tables? Never mind, in this system you don't need them beyond 5 × 5!
Suppose you need 8 x 7
8 is 2 below 10 and 7 is 3 below 10.
Think of it like this:

```
8    2

7    3
5    6   answer
```

Fig.1

The answer is 56.
The diagram below shows how you get it.

```
8    2
  × |
7    3
5    6   answer
```

Fig.2

You subtract crosswise 8-3 or 7 - 2 to get 5, The figure of the answer. And you multiply vertically: 2 x 3 to get 6,the figure 2 of the answer.

Example3 See how far the numbers are below 10, subtract one number's deficiency from the other number, and multiply the deficiencies together.

7 x 6 = 42

```
7    3
  × |
6    4
3   12   = 42
```

Here there is a carry: the 1 in the 12 goes over to make 3 into 4.

Suppose you want to multiply 88 by 98.the answer immediately, using the same methodsbefore. Both 88 and 98 are close to 100. 88 is 12 below 100 and 98 is 2 below 100.You can imagine the sum set out like this:

```
88 - 12
   × |
98 -  2
86   24
```

As before the 86 comes from
Subtracting crosswise: 88 - 2 = 86
(or 98 - 12 = 86: you can subtract either way, you will always get the same answer).
And the 24 in the answer is just 12 x 2: you multiply vertically.
So 88 x 98 = 8624

Example4 103 x 104 = 10712
The answer is in two parts: 107 and 12, 107 is just 103 + 4 (or 104 + 3),and 12 is just 3 x 4.
Similarly 107 x 106 = 11342
107 + 6 = 113 and 7 x 6 = 42

Example5 75^2 = 5625
75^2 means 75 x 75.The answer is in two parts: 56 and 25.
The last part is always 25.
The first part is the first number, 7,

multiplied byte number "one more", which is 8: so 7 x 8 = 56

Similarly square of 85= 7225 because 8 x 9 = 72.

Example632 x 38 = 1216

Both numbers here start with 3 and the last Figures (2 and 8) add up to 10.So we just multiply 3 by 4 (the next number up)to get 12 for the first part of the answer.

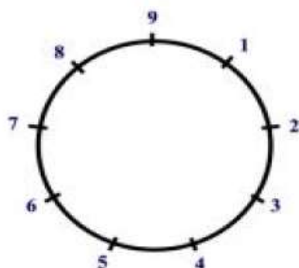And we multiply the last figures: 2 x 8 = 16 to get the last part of the answer.

Diagrammatically:

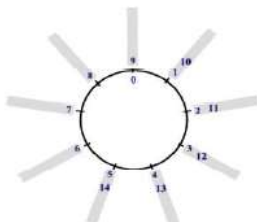$$2 \times 8 = 16$$
$$3\ 2 \times 3\ 8 = 1\ 2\quad 1\ 6$$
$$3 \times 4 = 12$$
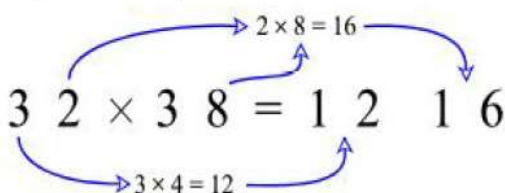
And 81 x 89 = 7209

Example7THE NINE-POINT CIRCLE

Since all numbers, no matter how long, can be reduced to a single figure every number finds its place on the nine-point circle:

This circle shows the numbers from 1 to 9 and continuing to number round the circle would put 10 at the same place as 1. 11 would be at the same place as 2 and so on as shown below:

Notice also that 0 goes at the same place as 9 because, numbering backwards round the circle, 0 comes before 1.So all numbers will have their place somewhere round this circle. Now, looking at the last circle, the digit sum of 10 is 1, and 10 is next to 1 on the circle. The digit sum of 11 is 2, and 11 is next to 2.And so on.

To find which branch of the circle a number is on we simply find its digit sum. For example the digit sum of 34 is 7 so 34 will come on the '7 branch'.

You could check this by continuing to number round the circle until you get to 34. 77 will be on the '5 branch' as 77=14=5.

Suppose you want to check that the simple addition sum below is correct.

$$\begin{array}{r} 4\ 3 \\ 3\ 2\ + \\ \hline 7\ 5 \end{array}$$

We find the digit sums of 43, 32 and 75 and check that the first two digit sums add up to the third digit sum.

$$\begin{array}{r} 4\ 3 \\ 3\ 2\ + \\ \hline 7\ 5 \end{array} \qquad \begin{array}{r} 7 \\ 5\ + \\ \hline 3 \end{array}$$

The digit sums are shown on the right and

7 + 5 = 3 is correct in digit sums because 7 + 5 = 12 = 3 (1 + 2 = 3)

This indicates that the answer is correct.

5.CONCLUSION:

1. Basic calculations right from addition, subtraction, multiplication, division, nth power, nth root to finding factors, roots of the equations, transcendental numbers, geometry, trigonometry, differential and integral calculus etc can be done through vedic mathematics. Their applications are all well noted in all walks of life and almost all subjects.

2 .he Sutras apply to and cover almost every branch of Mathematics. They apply even to complex problems involving a large number of mathematical operations. Application of the

Sutras saves a lot of time and effort in solving the problems, compared to the formal methods presently in vogue. Though the solutions appear like magic, the application of the Sutras is perfectly logical and rational. The computation made on the computers follows, in a way, the principles underlying the Sutras. The Sutras provide not only methods of calculation, but also ways of thinking for their application.

3 .Vedic Mathematics seeks to present an integrated approach to learning Mathematics with keenness of observation and inquisitiveness, avoiding the monotony of accepting theories and working from them mechanically. The explanations offered make the processes clear to the learners. The logical proof of the Sutras is detailed in algebra, which eliminates the misconception that the Sutras are a jugglery.

4. Application of the Sutras improves the computational skills of the learners in a wide area of problems, ensuring both speed and accuracy, strictly based on rational and logical reasoning. The knowledge of such methods enables the teachers to be more resourceful to mould the students and improve their talent and creativity. Application of the Sutras to specific problems involves rational thinking, which, in the process, helps improve intuition that is the bottom - line of the mastery of the mathematical geniuses of the past and the present such as Aryabhatta, Bhaskaracharya, Srinivasa Ramanujan, etc.

5 Vedic Mathematics introduces the wonderful applications to Arithmetical computations, theory of numbers, compound multiplications, algebraic operations, factorizations, simple quadratic and higher order equations, simultaneous quadratic equations, partial fractions, calculus, squaring, cubing, square root, cube root and coordinate geometry etc.

6. Uses of Vedic Mathematics:

O It helps a person to solve mathematical problems 10-15 times faster

O It helps m Intelligent Guessing

O It reduces burden (need to learn tables up to 9 only)

O It is a magical tool to reduce scratch work and finger counting

O It increases concentration.

O It helps in reducing silly mistakes

6.Books for Reference:

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