Hamsa Ksheera (2024) Vol 1 (1): 23-37
Journal website: www.sdmmmkmysore.in

A REVIEW ARTICLE ON VEDIC MATHEMATINAM

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Received July 22 2023; Accepted November 2 2023

ABSTRACT: Vedic mathematics is considered one of the good ways to make an individual concentrate or get attracted towards maths and also it helps in increasing IQ of an individual . All the sutra's used have an interesting way of short cut ideology from this study. One can conclude that modern teaching with a speed of calculation this would be a fun with maths and also creates the interest, all the sutra's have its own methodologies in working with the type of mathematical operation to be done . This is the one which provides more systematic, simplified & faster than conventional system. the most significant quality of vedic math is its consistency. As it's very flexible one can use their own approach which promotes creativity and the merge is concepts with intuition. One of the main reasons in learning this is the competition level that the students facing in any sort of competitive exams like SSC, IBPS, RRB, UPSE, CAT, MAT or any kind of aptitude exams which comprises the calculation sections. This helps get an accurate answer in short period of time.

KEY WORDS: vedic mathematics, algebraic connection, sutras

INTRODUCTION

In this newly emerging world of with all AI's getting emerged and the technologies getting improved a lot , parents or mathematics teachers would have some or the other common questions on the concept of Vedic maths:

- *Meaning of Vedic maths*
- *How beneficial is to a child*
- *Will it help to overcome a mathematical operations and make their children competitive and more innovative in maths?*
- *What are its features, benefits, importance, application and curriculum?*
- *What's a right age to start learning it?*

Vedic Maths (The Sanskrit term) - "Veda" means "knowledge" [1]

The method of doing fastest calculations with some sort of Vedic Sutras.

Which saves time in doing mathematical operations which has a benefits and features to develop mental maths also speed up the calculation.

An old system of calculation found in the Vedas between 1911 and 1918 by **Shri Bharati Krishna Tirathji**, who was born in 1884 in PurI, Orissa, who have learned these techniques from **"Rig Veda" [2]**.

Its wll with 16 main sutras and 13 sub-sutras- these can be used in :

- ✧ Addition
- ✧ Subtraction
- ✧ Multiplication
- ✧ Division
- ✧ Measurement
- ✧ Arithmetic
- ✧ Algebra
- ✧ Geometry
- ✧ Calculus
- ✧ data commercial math, and so on.

Father of Vedic Mathematics and History

ShriBharati Krishna Tirathji who is the Father of Vedic maths. He took to self-realization at ShringeriMatha with the guidance of ShriShankracharya, ShriSachidananda Shiva AbhinavaNarsimhaSaraswati; who gave all his 7 years of time in deep meditation and study of Vedanta and lived the life of a Sadhu from 1911 to 1918. During this period, the 16 Sutras of Vedic Math's were made [3].

He was called ShriBhartiKrishna Tirthaji after being initiated into Sanyas in July 1919 by Shri Trivikram Teerathaji of Varanasi.[(3)]

Shri Trivikram Tirathji appointed him as the Head of Dwarikapeeth in 1921. Later he headed the Govardhan Math Monastry, Puri, and Orissa from 1925 to till his Mahasmadhi in the year 1960.[(3)]

Benefits of Vedic math's to Student

- ➢ *Builds Speed and Accuracy in math's*
- ➢ *Reduce Rough Work*
- ➢ *Save Time in Calculations*
- ➢ *Confidence would be Higher*
- ➢ *Helps in Competitions*
- ➢ *Easy to Pick up and Learn*
- ➢ *Bring enjoyments , interests in working maths*
- ➢ *Increases Visualization of the problem level*
- ➢ *develops Logical Reasoning*
- ➢ *Builds Mental Agility*
- ➢ *It increases the Concentration*

FEATURES OF VEDIC MATHS--

- INTEGRITY:

All 16 sutras are related to one another for making it easier for better understanding; one single sutra can be used to solve multiple arithmetic calculations using one rule.
For example: NikhilamNavatascaramamdasathah is used for both general multiplication and division [4].

- SIMPLICITY:

Being in this technological world, simplicity which is the best way of saving time and increasing productivity.We come up with a solution of the most complicated multiplication problems that involve more than 5 step can be solved using one single and simple step which is the uniqueness of Vedic Maths [4].

- CREATIVITY:

The best practice to solve problem is to look at perception which needs creativity and understand that there are more ways to solve the problem, which encourages the student to find a unique approach to solve any problem [4].

- FAST AND ACCURATE RESULT:

Mental calculation is the main strategy followed by Vedic Maths , where a problem can be solved using a simple method which saves the time also increases the productivity since the steps are less probability of accuracy is more [4].

- INTUITIONAL ABILITIES:

Based on all the above features, it's clear that Vedic Maths gives faster and accurate results and this is the quality which encourages the student to be more confident ,competent, also increasing there intuition abilities [4].

- IMPROVE MEMORY AND CONCENTRATION:

As most of the calculations are done mentally, and with very few steps, students remember the basics with ease, which improves their memory and concentration [4].

- ALGEBRAIC CONNECTION:

When one practices these math tricks of arithmetic calculations based on the Vedic Maths method of learning, it is easier for them to apply it in any algebraic problem 4].

- APPLICATION AREA:

Vedic Maths Sutras covers all the nook and corner in Mathematics, starting from arithmetic operations, geometry, trigonometry, analytical astronomy, calculus, and differential and integral, etc. the list goes on providing endless possibilities of applicationS [4].

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- INNOVATION: Vedic Maths welcomes more scholars and mathematicians to implement these methods with added creativity and innovate more math tricks in modern mathematicS [4].

16 sutras explained:

• ***EKADHIKENA PURVENA*** (BY ONE MORE THAN THE PREVIOUS) COROLLORY**: ANURUPYENE**	Useful in finding the product of numbers, if the sum of unit digits of the two numbers is 10. E.g. 46 x 45=? = (first digit x one more than it) (product of unit digits of both numbers) I.e,(4 x 5) (6 x 5)=624
• ***NIKHILAM NAVATASHCARAMAM DASHATAH***	Commonly used in subtraction of a number from the powers of 10

(ALL FROM 9 AND LAST FROM 10) COROLLORY:**SISYALESESA MAJNAH**	
• **URDHVA-TRIBHAGYAM** (VERTICALLY AND CROSSWISE) COROLLORY:**ADYAMADYEN ANLYAMANLYENA**	for multiplications and the formula used is explained below. ab x cd=(ac) (ad + bc) (bd)
• **PARAVARTYA YOJAYET** (TRANSPOSE AND ADJUST) COROLLORY:**KEVALAIH SAPTAKAM GUNYAT**	This is used to solve division problems when the divisor is a little greater than the nearest power of 10.
• **SHUNYAM SAAMYASAMUCCAYE** (WHEN THE SUM IS THE SAME. THAT SUM IS ZERO) COROLLORY:**VESTANAM**	This is used to solve equations in the form ax + b=cx +d So x=$\frac{d-b}{a-c}$ (x+a) (x+b) =(x+c) (x+d) So x=cd-a ($\frac{b}{a}$) +b – c-d
• ***ANURUPYE SHUNYAMANAT*** (IF ONE IS IN RATIO THE OTHER IS EQUAL TO ZERO. THIS IS ALSO USED TO SOLVE EQUATIONS.) COROLLORY:**YAVADUNAM TAVADUNAM**	Suppose: 2x + 4y=8 and 4x + 6y=16, the ratio of terms with x=$\frac{2x}{4x}$ =$\frac{1}{2}$ The ratio of R.H.S term is also $\frac{8}{16}$ =$\frac{1}{2}$ hence the other variable, in this case y=0 Substituting this value of y in any other of the two equations, we can get value of x 2x + 4 (0)=8 2x=8 hence x=$\frac{8}{4}$=2.
• ***SANKALANA-VYAVAKALANABHYAM*** (BY ADDITION AND SUBTRACTION) COROLLORY:**YAVADUNAM TAVADUNAM VARGA YOJAYET**	Used to solve equations. (If the coefficient of 1 variable in same in both the equation irrespective of the sign) Then the two equations can be added and subtracted and solved for variables e.g., 4x + 2y=6 ----(1)

	2x + 4y=7 ----(2) Now add equations 6x + 6y=13 or 6 (x + y)=13 or $X + y=\frac{13}{7}$ ---- (3) Subtract eq 2 for eq 1 2x -2y=-1 2 (x -y)=-1 or $X – y= -\frac{1}{2}$ ----- (4) hence $Y=x + \frac{1}{2}$ --- (5) substitute this in eq 3 we get X + (x + ½) $=\frac{13}{7}$ solving for x $X=\frac{19}{7}=2.71$ And y=x + 0.5 fromeq 5 y=2.71 +0.5=3.21
• ***PURANAPURANABHYAM*** (BY THE COMPLETION OR NON-COMPLETION) COROLLORY**:ANTYAYORDASHAKE PI**	This can be used to solve addition problems when the unit digits of the numbers add up to 10 e.g., number 22 +18 unit digits add up to 10. try 295 + 46 + 28 + 15 + 44 + 22=? Now we need to check and pair them in such a way that their unit places add up to 10. So (295 + 15) + (46 + 44) + (28 + 22) 300 + 90 + 50=440.
• ***CHALANA KALANABYHAM*** (DIFFERENCE AND SIMILARITIES) COROLLORY**:ANTYAYOREVA**	This sutra can be found in • calculus to find roots of a quadratic equation • differential calculus • factorizing 3rd, 4th, and 5 degrees expression. Finds very specialized applications in the area of higher mathematics .
• ***YAVADUNAM*** *(WHATEVER THE EXTENT OF ITS DIFICIENCY)* COROLLORY**:SAMUCCAYAGUNITAH**	This is used to find squares of numbers that are close to the powers of base 10. Compare the number with the closed base to it and find the deficiency or excess. Square the difference and this is one part of the answer, reduce the given number or increase it by the difference it has to the power of base 10

• ***VYASHTISAMANSTIH*** (PART AND WHOLE) COROLLORY**:LOPANASTHAPANABHYAM**	This helps in the factorization of quadratic equations.
• ***SHESANYANKENA CHARAMENA*** *(THE REMINDERS BY THE LAST DIGIT)* COROLLORY**: VILOKANAM**	This sutra gives you the process of converting fractions to decimals. e.g. $\frac{1}{29}$ ➢ The last digit of the divisor should be 9. It is in this case, now increase the value by 1 of the number next to 9. So, the number is 2 and increasing it by 1 makes it 3 ➢ The dividend is 1 now it has to be divided by 3 so, ➢ 1 / 3 ➢ Doing it mentally it will be 0.0 and remainder 1 and it is written as ➢ 0.10 and 10 is divided by 3 and it will be written as 3 and remainder 1 written to left ➢ 01 3 now 13 is to be divided by 3 and it will be written as 4 and remainder 1 written to left 0.101314 and keep on dividing it by 3 to as many decimal places as needed. For three decimal places the answer is 0.034
• ***SOPAANTYADVAYAMANTYAM*** (THE ULTIMATE AND TWICE THE PENULTIMATE.) COROLLORY**:GUNITASAMUCCAYAH SAMUCCAYAGUNITAH**	Used to find solution of equations in the form $\frac{1}{ab}+\frac{1}{ac}=\frac{1}{ad}+\frac{1}{bc}$ a, b, c and d are in arithmetic progression b=a + z c=a + 2z d=a + 3z solution for such equations is 2c + d=0 e. g.

	$\frac{1}{(x+1)(x+2)} + \frac{1}{(x+1)(x+3)} = \frac{1}{(x+1)(x+4)} + \frac{1}{(x+2)(x+3)}$ the solution would be 2(x +3) + (x+4) =0 2x +6+x+4=0 3x + 10=0 X=$-\frac{10}{3}$
• ***EKANYUNENA PURVENA*** (BY ONE LESS THAN THE PREVIOUS.) COROLLORY**:DHVAJANKA**	Multiplication can be done using this sutra only when the multiplier consists of only 9 e.g,12 x 99=? • Reduce 1 from multiplicand i.e., 12-1=11 • The other part of the answer would be99-11=88 (complement of 99) answer is 1188
• ***GUNITA SAMUCHAYA*** *(THE PRODUCT OF THE SUM IS EQUAL TO THE SUM OF THE PRODUCT)* COROLLORY***:*****DWANDWA YOGA**	It is used to find the correctness of the answers in factorization problems and it states that the "Sum of the coefficients in the product is equal to the sum of coefficients of the factors" and if this condition is satisfied then the equation can be considered to be balanced. e.g. let us consider a quadratic equation 8 x^2+ 11x + 3=(x+1)(8x+3) the sum of coefficients is 8+11+3=22 Product of the sum of coefficients of the factors=2 (8+3)=2 x 11=22 Since both, the totals tally the equation is balanced and correct.
• ***GUNAKASAMUCHYA*** (THE FACTOR OF THE SUM IS EQUAL TO THE SUM OF THE	This sutra holds good for a perfect number. Let us find the factors of number 28, 1 x28=28 2 x 14=28 4 x 7=28 So, in this case, the sum of factors is 1+2+4+7+14=28

FACTORS.) COROLLORY:**ADYAAM ANTYAM MADHYAM**	The sum of factors equals the factor of the sums, so 28 is said to be a perfect number.

Vedic math's Tricks on:

Addition

Vedic maths based on the Sutras is described:

- *Suddha (Purification): This is the primary and standard from of Vedic mathematics that involves addition and subtraction of two numbers-X and Y (X and Y are variables)*
- *Urdhvatiryagbhya (Vertically and crosswise)*
- *Dhvajaka (on the flag)*

Addition with Double to Single Digits:

Add Ten's column to Ten's and one's column to one's
Example –

Question: Solve the Problem

15
+3

Solution: Step 1: 1 tens or 10
Step 2: Add one's column values5 + 3 = 8
Step 3: Add 1tens + 8i.e., 10 + 8 = 18
Ans: 18

Addition with 2 Digits Numbers

Add Ten's column to Ten's and one's column to one's
Example -

Question: Solve the Problem

57
+27

Answer: Step 1: 5 tens + 2 tens i.e., 50 + 20 = 70 or 7 tens
Step 2: Add one's column values 7 + 7 =14
Step 3: Add 7tens + 14 i.e., 70 + 14
Ans:84

2. Subtraction

Vedic Math Sutra
All from 9 and last from 10, answer reduce by 1.

Start from right to left subtract every digit from 9 except the last from 10 and answer reduce by 1.

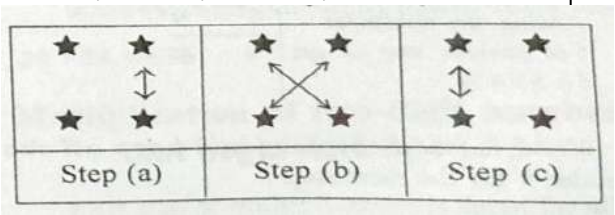
Example:

70,000
– 8,963

Step 1: Subtract 3 from 10 i.e., 10 – 3 = 7
Step 2: Subtract 6 from 9 i.e., 9 – 6 = 3

Step 3: Subtract 9 from 9 i.e., 9 – 9 = 0
Step 4: Subtract 8 from 9 i.e., 9 – 8 = 1
Step 5: Answer reduce (less) by 1 i.e., 7-1 = 6
Ans: 70,000 – 8,963 = 61,037

Multiplication
Vedic Maths Trick Using Cross-Wise Method



Step – 1: First of all, write the numbers in vertical format.

Step – 2: Multiply the ones digit by ones digit.

Step –3: Make a cross, find the product of tens digit of one number by ones digit of the other number and repeat the same with other two numbers. Now add the products.

Step – 4: Now multiply the tens digit by digit.

Step – 5: Now there are three numbers. Keep on taking only one digit starting from right side and add the extra number to the next place.

Example 1.

6 9
×2 5

$9 \times 5 = 45$
$6 \times 5 + 2 \times 9 = 30 + 18 = 48$
$6 \times 2 = 12$
Take 5 of 45 and add this 4 to 48, so you'll get 52.

Now take 2 of 52 and add this 5 to 12, so you'll get 17.

Write this 17 as it is.
So your answer is 1725

Example 2.

1 9
× 1 3

9 × 3 = 27. Just write 7 in units place
19 + 3 = 22+ 2 = 24 write in tens place
Answer is 247

Example 3.

2 9
× 2 5

9 × 5 = 45 (write 5 in once place and keep remainder to next step)

29 + 5 = 34

2 × 34 = 68

68 + 4 = 72 (add the remainder hear)

Answer is 725

Example 4.

8 4 9
× 7 6
64524

9 × 6 =54
(4×6)+(9×7)=87
5+87=92
(8×6)+(4×7)=76
76+9=85
87×7=56
8+56=64

Example 5.
Multiplication of (5 × 2) digit no

5 8 7 6
× 6 9
405444

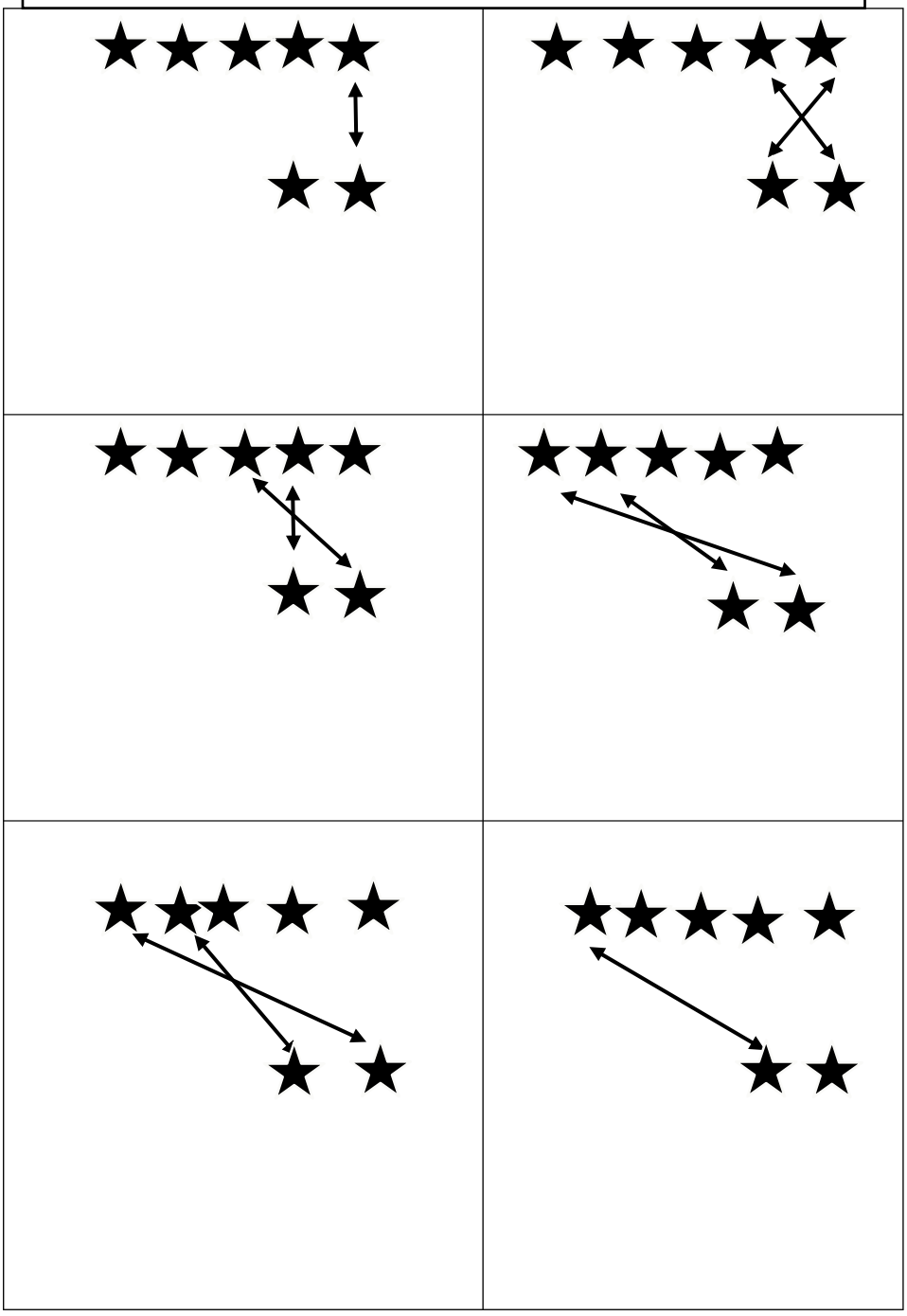
6 × 9 =54

(7×9)+(6×66)
=9975+99=104

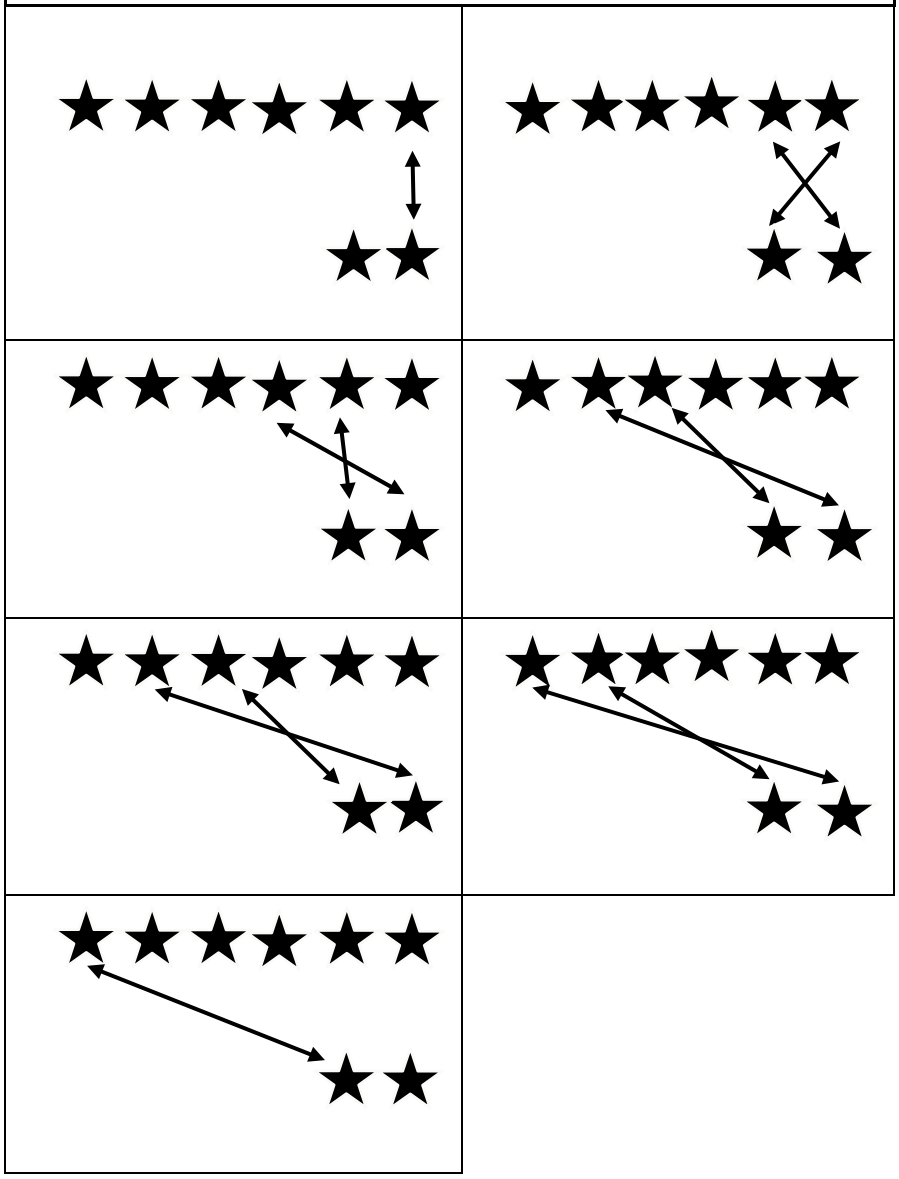
(8×7)+(7×6)=114
10+114=124

(5×9)+(8×6)=93
12+93=105 5×6=30
30+10=40

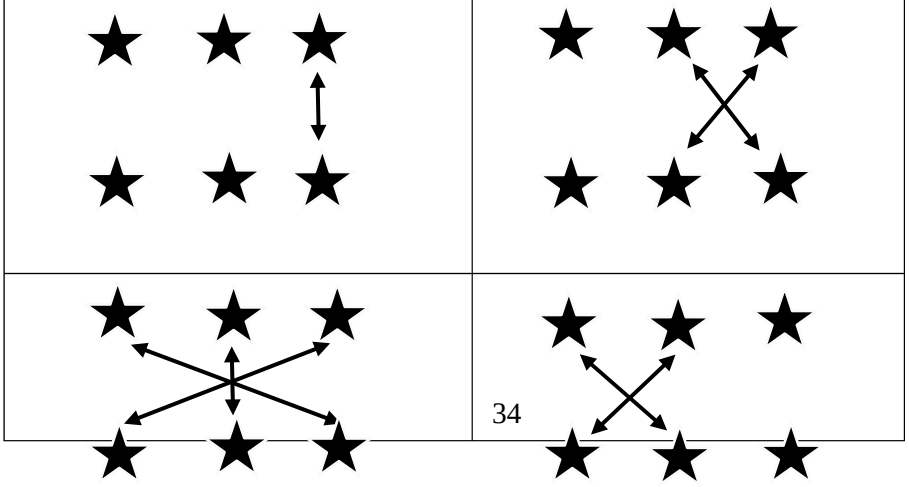
Multiplication of (5 × 2) digit no

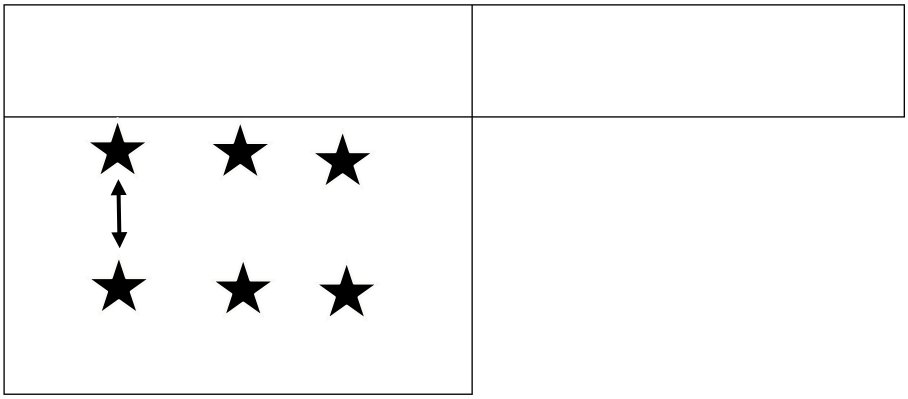


Multiplication of (6× 2) digit no



Multiplication of (3 × 3) digit no





4. Squares

Squares of 2 Digit Numbers
Step 1: Multiply one's digit by itself.
Step 2: Multiply 2 by the product of ones and tens digit.
Step 3: Multiply tens digit by itself.
Step 4: Now there are three numbers. Keep on taking only one digit starting from right side and add the extra number to next place.

Example: Find the square of 59.
Step 1 : $9 \times 9 = 81$
Step 2: $2 \times 5 \times 9 = 90$
Step 3: $5 \times 5 = 25$
Step 4: Explained Below
Take 1 of 81 and add 8 to 90. So, you'll get 98.

Take 8 of 98 and add 9 to 25. So, you'll get 34.**Therefore, the required answer is 3481.**

Example: Find the square of 86.

Step 1: $6 \times 6 = 36$
Step 2: $2 \times 8 \times 6 = 96$
Step 3: $8 \times 8 = 64$
Step 4: Take 6 of 36 and add 3 to 96. So, you'll get 99.
Take 9 and add 9 to 64. So, you'll get 73.**Therefore, the required answer is 7396.**

5. Division

A Upasutra that helps in the division of two numbers; it can even give the decimal number in one single step

When the divisor is smaller and closer to the power of 10 (Nikhilam)

Divide 231 by 9

I. 9 is short of 10

II. Split 231 as 23(quotient) & 1(remainder)

III.

23	/	1
+3		+6
26		7
↓		↓
Quotient		Remainder

When the divisor is greater and closer to the power of 10 (Paravartya Sutra)

432 divided by 11

I. Remove 1 from 11 and transpose the other, we get 1

II. Split 432 as 43(quotient) & 2(remainder)

III.

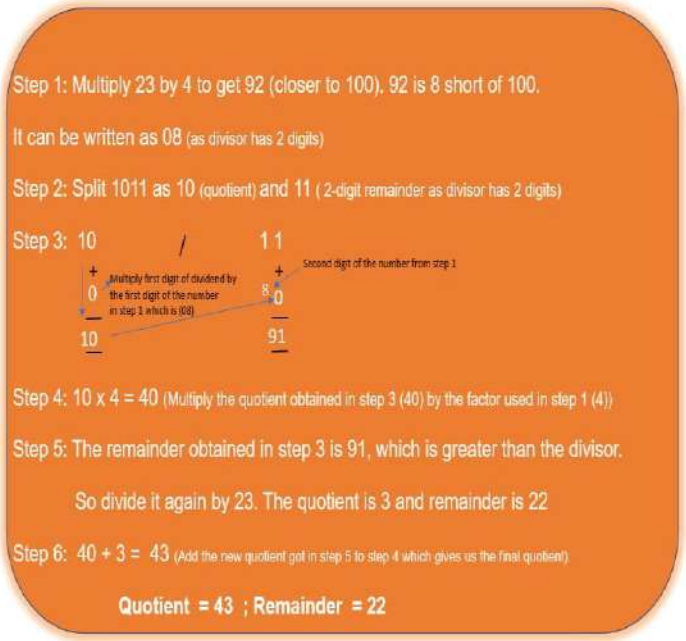
43	/	2
+ 4		+1
41		3

IV. 41=40-1=39(quotient) & 3(remainder)

Multiply 1st digit of dividend by number from step 1

When the divisor does not come under the rules of Nikhilam or Paravartya Sutras (Anurupyena Sutra)

1011 divided by 23

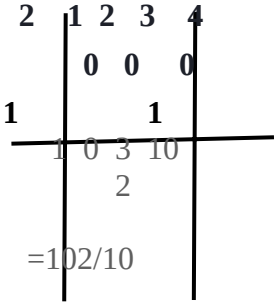


Flag Method (Division)

Direct Flag Method is a General Method of Vedic Mathematics is used to carry division of anytypes of numbers.

1234/12

1233 ÷ 12



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ACKNOWLEDGEMENT: The author extend her acknowledgement to the Principal and faculties MMK & SDM MMV College, K R Puram for providing the required guidance and support

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