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# VEDIC SPEED MATHEMATICS

(Journey from Limited Intelligence to Human Bio-Calculator)

Become MatheMagician in 21 Days

Solve Complex Problems in Few Seconds

Come Out of Maths Phobia

Chaitanya A. Patil

[www.chaitanyapatil.in/vm](http://www.chaitanyapatil.in/vm)

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## **Salient Features of this Book:**

- Simple and Easy English
- Working Procedure
- Many Solved Examples with Relevant Explanation
- Step by Step Solution for Better Understanding
- Pictorial Guidelines for Easy Remembrance
- Sutras Name both in English and Devanagari
- Topic, Case, Method and Sutra wise Classification of Problems
- Just Remember One Liner Sutra & Solve Complex Problems in Few Seconds
- Exercise with Answer Keys
- Learn with Fun Concept
- and Many More..

## **Benefits of Learning Vedic Mathematics:**

- It is very Simple, Efficient, Fast, Coherent, Flexible & Straight Forward.
- It is Amazingly Compact and Powerful System of Calculation.
- Leads to Improvement in Mental Ability, Sharpness, Creativity & Intelligence.
- Problems are reduced to One Line Answers.
- It can be Learnt and Mastered with Ease and in little Time.
- Covers from Basic Numeracy Skills to Advanced Math Topics.
- Faster Calculations and High Accuracy level when compared to the Conventional Methods.
- Increased Concentration and Confidence.
- Vedic Mathematics System also provides a set of Independent Cross Checking Methods.
- Helps in Achieving Academic Success.

## How to Use this Book...

1. Switch to Unit (or Point) of your Interest (or Choice).
2. Read Working Procedure.
3. Go through Solved Examples.
4. Read Explanation of Examples (if required).
5. Bonus: Observe Pictorial Guidelines (Graphical Representations) for easy Remembrance.
6. Solve Exercises (Use Pen/Pencil and Paper/Slate).
7. Practice, Practice, Practice. Practice makes a man Perfect. Experience, after all is the best Instructor.
8. After Practice, you will be able to solve any problems mentally.

### NOTE:

- In this book, in most of the solved examples, we solved problems in many steps. This is for your better understanding. Once you understand, skip the steps and directly go for answers.
- Last Chapter is Introduction to Vedic Mathematics. Intentionally we kept it at last. While reading any unit or point of your interest, if required you can switch to this unit for detailed explanation of Sutras and Sub Sutras.
- Read: Sutra as Formula; Sub Sutra as Corollary; Sutras as Formulae; Sub Sutras as Corollaries

# Contents of Vedic Mathematics

## Level – I:

1. Multiplication
2. Division
3. Addition
4. Subtraction

## Level – II:

5. Squares
6. Square Roots
7. Cubes
8. Cube Roots
9. Digit Sums
10. Divisibility
11. Decimals, Fractions and Percentages
12. Introduction to Vedic Speed Mathematics

## Level – III:

13. Polynomials
14. Factorization
15. Highest Common Factor (HCF)
16. Simple Equations
17. Quadratic Equations
18. Cubic Equations
19. Biquadratic Equations
20. Simultaneous Equations

**Note:** **Part-I** includes Level I & Level II. **Part-II** includes Level III. 'Introduction to Vedic Speed Mathematics' Unit is included in both parts (Part-I and Part-II). More Info: [www.chaitanyapatil.in/vm](http://www.chaitanyapatil.in/vm)

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# Unit 1: MULTIPLICATION

Multiplication means times or repeated addition.

Ex.1:  $13 \times 3 = 39$  (or  $13 + 13 + 13 = 39$ )

Ex.2:  $24 \times 4 = 96$  (or  $24 + 24 + 24 + 24 = 96$ )

## Points Covered:

- 1.1 Multiplication using Base Method
- 1.2 Multiplication using Criss Cross Method
- 1.3 Other Methods
- 1.4 Exercises & Answers

## 1.1 Multiplication using Base Method

1. Sutra Used is: 2. Nikhilam Navataścaramam Daśatah (निखिलं नवतश्चरमं दशतः) **Meaning:** All from 9 and the last from 10.
2. Bases are any positive numbers ending with 0's (zeroes). Ex: 70, 80, 90, 140, 1300, 5600 etc.
3. Working (or functional) Base is always power of 10. Ex: 10, 100, 1000, 10000, 100000 etc.
4. **Complement** or Dificiency = Number – Base
5. **Surplus** = Number – Base

Number	Base	Complement
8	10	-2
93	100	-7
87	100	-13
974	1000	-26
57	60	-3
1846	1900	-54

Number	Base	Surplus
12	10	+2
107	100	+7
1039	1000	+39
57	50	+7
1846	1800	+46

Abbreviations Used:

**D:** Digit; **B:** Base

**C:** Complement; **S:** Surplus

**BM:** Base Multiple; **BR:** Base Ratio

**Case 1: When both numbers (multiplicand and multiplier) are less than the working base:**

**Working Procedure:**

1. Write multiplicand and multiplier one below the other.
2. Write complements of multiplicand and multiplier to its right side with signs.
3. Answer consists of two parts. Left and Right.
4. Left Part: Evaluating any of the cross values.
5. Right Part: Product of both complements (right side values).
6. **Caution:** Total number of digits in the Right Part should be equal to total number of zeroes in the base. If lesser, add required number of zeroes before the right part. If greater then pass the carry (left most excess digits of right part) to left part.

<b>Ex.1: <math>7 \times 8</math></b>
Base:10
7 -3
8 -2
-----
5   6
<b>56</b>

**Ex. 1:** Here we need to multiply 7 and 8. We choose base as 10, as both the numbers (7 and 8) are nearer to 10. Numbers 7 and 8 are written one below the other. Their complements are -3 and -2 respectively and they are written at right side. Left Part is 5 {7+(-2) or 8+(-3)}. Right Part is product of complements i.e.  $-3 \times -2 = 6$ . So final answer is: 56

**Ex.2:  $6 \times 7$**   
 B:10  
 6    -4  
 7    -3  
 -----  
 3 | 12  
 3+1 | 2  
 4 | 2  
**42**

**Ex. 2:**  $6 \times 7$ ; complements are -4 and -3. Left Part is 3 (6-3 or 7-4) and Right Part is 12 ( $-4 \times -3$ ). Here base is having only one zero, so right part should be of single digit. Pass 1 (leftmost excess bit of right part) as carry to Left Part. Left Part:  $3+1=4$  Right Part: 2. So final answer is: 42

**Ex.3:  $94 \times 96$**   
 B:100  
 94    -6  
 96    -4  
 -----  
 90 | 24  
**9024**

**Ex.3:**  $94 \times 96$ ; Base is 100 as both the given numbers (94 and 96) are closer to 100; complements are -6 and -4. Left Part is 90 (94-4 or 96-6). Right Part is 24 ( $-6 \times -4$ ). So final answer is: 9024

<b>Ex.4: <math>90 \times 89</math></b>	
B:100	
90	-10
89	-11
-----	
79	110
79+1	110
80	10
<b>8010</b>	

**Ex.4:**  $90 \times 89$ ; complements are -10 and -11. Left Part is 79 (90-11 or 89-10). Right Part: 110 ( $-10 \times -11$ ). Here base is having two zeroes, so right part should be of two digits. But, Right Part is of three digits. So 1 is passed as carry to Left Part. So Left Part becomes  $79+1=80$  and Right Part becomes 10. So final answer is: 8010

<b>Ex.5: <math>997 \times 993</math></b>	
B:1000	
997	-3
993	-7
-----	
990	021
<b>990021</b>	

**Ex.5:**  $997 \times 993$ ; Base is 1000 as both the given numbers (997 and 993) are closer to 1000; complements are -3 and -7. Left Part is 990 (997-7 or 993-3). Right Part is 021 ( $-3 \times -7$ ). So final answer is: 99021.

**Note:** Result of product of complements is 21. But we need to add one ZERO before 21. Because base is 1000 and having THREE zeroes.

**Ex.6: 950×930**  
 B:1000  
 950    -50  
 930    -70  
 -----  
 880 | 3500  
 880+3 | 500  
 883 | 500  
**883500**

**Ex.6:** 950×930: complements are -50 and -70. Left Part is 880 (950-70 or 930-50). Right Part is 3500 (-50\*-70). Here base is 1000 (Three Zeroes) and Right Part is of 4 digits. So 3 is passed as carry to Left Part. So Left Part becomes 880+3=883 and Right Part becomes 500. So final answer is: 883500

**Case 2: When both numbers are greater than the working base:**

**Working Procedure:**

1. Write multiplicand and multiplier one below the other.
2. Write surplus of multiplicand and multiplier to its right side with signs.
3. Left Part: Adding any of the cross values.
4. Right Part: Product of both surpluses (right side values).
5. **Caution:** Total number of digits in the Right Part should be equal to total number of zeroes in the base. If lesser, add required number of zeroes before the right part. If greater then pass the carry (left most excess digits of right part) to left part.

**Ex.1:  $12 \times 14$**

```
B: 10
12 +2
14 +4
-----
16 | 8
168
```

**Ex.1:**  $12 \times 14$ ; here we need to multiply 12 and 14. Numbers 12 and 14 are written one below the other. Their surplus +2 and +4 respectively and they are written at right side. Left Part is 16 ( $12+4$  or  $14+2$ ). Right Part is product of surplus i.e.  $2 \times 4 = 8$ . Here base is 10 (Single Zero). Right part is of single digit. So final answer is 168

**Ex.2:  $16 \times 17$**

```
B: 10
16 +6
17 +7
-----
23 | 42
23+4 | 2
27 | 2
272
```

**Ex. 2:**  $16 \times 17$ ; surplus: +6 and +7. Left Part is 23 ( $16+7$  or  $17+6$ ). Right Part is 42 ( $6 \times 7$ ). Base is 10 (Single Zero). But Right part is having two digits. Leftmost digit of right part (here it is 4) is taken to Left part as carry. So Left part becomes 27 ( $23+4$ ) and Right part becomes 2. So final answer is 272

**Ex.3:  $109 \times 111$**

B: 100

109 +9

111 +11

-----

120!99

**12099**

**Ex. 3:**  $109 \times 111$ ; surplus: +9 and +11. Left Part is 120 ( $109+11$  or  $111+9$ ). Right Part is 99 ( $9 \times 11$ ). Here base is 100 (Two Zeroes). Right part is having two digits. So no any further calculations are required. The final answer is 12099.

**Ex.4:  $117 \times 110$**

B: 100

117 +17

110 +10

-----

127!170

127+1!70

128!70

**12870**

**Ex. 4:**  $117 \times 110$ ; surplus: +17 and +10. Left Part is 127 ( $117+10$  or  $110+17$ ). Right Part is 170 ( $17 \times 10$ ). Here base is 100 (Two Zeroes). But Right part is having three digits. Leftmost digit of right part (here it is 1) is taken to Left part as carry. So Left part becomes 128 ( $127+1$ ) and Right part becomes 70. So final answer is 12870

**Ex. 5:  $1020 \times 1033$**

B: 1000

1020 +20



$  \begin{array}{r}  1033 +33 \\  \text{-----} \\  1053 \mid 660 \\  \mathbf{1053660}  \end{array}  $
---

**Ex. 5:**  $1020 \times 1033$ ; surplus: +20 and +33. Left Part is 1053 ( $1020+33$  or  $1033+20$ ). Right Part is 660 ( $20 \times 33$ ). Here base is 1000 (Three Zeroes). Right part is having three digits. So no any further calculations are required. The final answer is 1053660.

<p><b>Ex.6: <math>1050 \times 1030</math></b></p> <p>B: 1000</p> $  \begin{array}{r}  1050 +50 \\  1030 +30 \\  \text{-----} \\  1080 \mid 1500 \\  1080+1 \mid 500 \\  1081 \mid 500 \\  \mathbf{1081500}  \end{array}  $
--

**Ex. 6:**  $1050 \times 1030$ ; surplus: +50 and +30. Left Part is 1080 ( $1050+30$  or  $1030+50$ ). Right Part is 1500 ( $50 \times 30$ ). Here base is 1000 (Three Zeroes). But Right part is having four digits. Leftmost digit of right part (here it is 1) is taken to Left part as carry. So Left part becomes 1081 ( $1080+1$ ) and Right part becomes 500. So final answer is 1081500

## 1.3 Other Methods

### Case 4: Multiplying numbers with repeating 9s

Sutra 14: Ekanyūnena Pūrvena (एकन्यूननेन पूर्वणे)

Meaning: By one less than the previous one.

Usage: This sutra is used to find a number one less than the given number.

Application: Multiplying numbers with repeating 9s.

Ex. Suppose given number is 87. Its previous number is  $87-1=86$ .

### Working Procedure:

1. Note down given numbers {multiplicand and multiplier (repeating 9s)} and base.
2. Answer consists of two parts (Left and Right).
3. Left Part is One less than the multiplicand (Multiplicand – 1).
4. Right Part = Base – Multiplicand.

**Ex.1:**  $7 \times 9$  (Base=10)

$(7-1) \mid (10-7)$

6 | 3

**63**

**Ex.2:**  $37 \times 99$  (Base=100)

$(37-1) \mid (100-37)$

36 | 63

**3663**

**Ex.3:**  $874 \times 999$  (Base=1000)

$(874-1) \mid (1000-874)$

873 | 126

**873126**

**Ex.4:**  $6457 \times 9999$  (Base=10000)

$(6457-1) \downarrow (10000-6457)$

6456  $\downarrow$  3543

**64563543**

**Ex.5:**  $24 \times 999$  (Base=1000)

$(24-1) \downarrow (1000-24)$

23  $\downarrow$  976

**23976**

### Exercise:

<b>1.</b> $14 \times 17$	<b>2.</b> $19 \times 16$
<b>3.</b> $121 \times 119$	<b>4.</b> $116 \times 109$
<b>5.</b> $1024 \times 1005$	<b>6.</b> $1039 \times 1010$
<b>7.</b> $88 \times 91$	<b>8.</b> $96 \times 89$
<b>9.</b> $99 \times 97$	<b>10.</b> $980 \times 978$
<b>11.</b> $976 \times 988$	<b>12.</b> $955 \times 990$
<b>13.</b> $971 \times 980$	<b>14.</b> $1024 \times 1010$
<b>15.</b> $1100 \times 1046$	<b>16.</b> $1020 \times 1005$
<b>17.</b> $89 \times 121$	<b>18.</b> $91 \times 115$
<b>19.</b> $94 \times 117$	<b>20.</b> $97 \times 109$
<b>21.</b> $990 \times 1050$	<b>22.</b> $977 \times 1020$
<b>23.</b> $455 \times 485$	<b>24.</b> $475 \times 485$
<b>25.</b> $585 \times 620$	<b>26.</b> $690 \times 725$
<b>27.</b> $78 \times 86$	<b>28.</b> $475 \times 520$
<b>29.</b> $477 \times 510$	<b>30.</b> $369 \times 764$
<b>31.</b> $415 \times 698$	<b>32.</b> $286 \times 478$
<b>33.</b> $389 \times 855$	<b>34.</b> $475 \times 996$

<b>35.</b> $785 \times 774$	<b>36.</b> $475 \times 875$
<b>37.</b> $9987 \times 9900$	<b>38.</b> $9985 \times 10200$
<b>39.</b> $7007 \times 7050$	<b>40.</b> $9875 \times 9980$
<b>41.</b> $78 \times 99$	<b>42.</b> $7 \times 99$
<b>43.</b> $874 \times 99$	<b>44.</b> $649 \times 999$
<b>45.</b> $87 \times 999$	<b>46.</b> $7436 \times 999$
<b>47.</b> $96354 \times 999$	<b>48.</b> $7465 \times 9999$
<b>49.</b> $316 \times 9999$	<b>50.</b> $547 \times 9999$
<b>51.</b> $54 \times 56$	<b>52.</b> $77 \times 73$
<b>53.</b> $736 \times 764$	<b>54.</b> $349 \times 351$

**Answers:**

<b>1.</b> 238	<b>2.</b> 304
<b>3.</b> 14399	<b>4.</b> 12644
<b>5.</b> 1029120	<b>6.</b> 1049390
<b>7.</b> 8008	<b>8.</b> 8544
<b>9.</b> 9603	<b>10.</b> 958440
<b>11.</b> 964288	<b>12.</b> 945450
<b>13.</b> 951580	<b>14.</b> 1034240
<b>15.</b> 1150600	<b>16.</b> 1025100
<b>17.</b> 10769	<b>18.</b> 10465
<b>19.</b> 10998	<b>20.</b> 10579
<b>21.</b> 1039500	<b>22.</b> 996540
<b>23.</b> 220675	<b>24.</b> 230375
<b>25.</b> 362700	<b>26.</b> 500250
<b>27.</b> 6708	<b>28.</b> 247000
<b>29.</b> 243270	<b>30.</b> 281916
<b>31.</b> 289670	<b>32.</b> 136708
<b>33.</b> 332595	<b>34.</b> 473100

<b>35.</b> 607590	<b>36.</b> 415625
<b>37.</b> 98871300	<b>38.</b> 101847000
<b>39.</b> 49399350	<b>40.</b> 98552500
<b>41.</b> 7722	<b>42.</b> 693
<b>43.</b> 86526	<b>44.</b> 648351
<b>45.</b> 86913	<b>46.</b> 7428564
<b>47.</b> 96257646	<b>48.</b> 74642535
<b>49.</b> 3159684	<b>50.</b> 5469453
<b>51.</b> 3024	<b>52.</b> 5621
<b>53.</b> 562304	<b>54.</b> 122499

## Unit 2: DIVISION

Division undoes Multiplication.

Ex.  $39 \div 3 = 13(Q); 0(R)$

**Q:** Quotient; **R:** Remainder

$$39 \div 3 = 13$$

$$\therefore 13 \times 3 = 39$$

( $\therefore$  Division undoes Multiplication.)

### Points Covered:

- 2.1 Division Using Base Method
- 2.2 Division using Transpose and Adjust
- 2.3 Division by FLAG Method
- 2.4 Exercise & Answers

### 2.1 Division Using Base Method

Sutra Used is: 2. Nikhilam Navataścaramam Daśatah

(निखिलं नवतश्चरमं दशतः)

Meaning: All from 9 and Last from 10.

**Note:** This Sutra is used when divisor is below the base (9, 8, 7, 94, 88, 978, 964, 9874 etc).

**Keywords:** Divisor, Dividend, Quotient, Remainder, Division, Left Part, Right Part, Vertical Line (|).

**In Ex. 1:** Divisor (9), Dividend (12), Quotient (1), Remainder (3), Division (Operation), Left Part (1), Right Part (2), Vertical Line (|).

**Working Procedure:**

1. **First Line:** Split the dividend into two parts (left and right) using vertical line (|). Total number of digits in right part should be equal to total number of zeroes in the base.
2. **Second Line: Left Part = Blank; Right Part = (p\*C); p is left part of first line and C is complement of divisor.**
3. **Third Line:** Add Left and Right Parts of First and Second Lines. **Left Part is Quotient and Right Part is Remainder.**
4. **Note:** If Remainder is greater than divisor, then divide Remainder by divisor using above process. For Quotient: Add left part of all sections and for Remainder just consider last section.

**Ex.1:12÷9**

B: 10; C: 1

9) 1|2

  |1

-----

1|3

Q:1; R:3

**Ex.1:** Here divisor is 9 and Dividend is 12. As divisor is of one digit, right part contains only one digit. So left part is 1 and right part is 2. In the second line, left part is blank and right part is  $1 \times 1 = 1$  (Left Part is 1 and complement is 1). In the third line we

add left and right parts. Left part becomes 1 (1+0) and right part becomes 3 (2+1). Left part is quotient and right part is Remainder. So 1 is quotient and 3 is Remainder.

<p><b>Ex.22: 320÷81</b>          B: 100; C: 19</p> $\begin{array}{r} 81 \overline{) 3 \mid 20} \\ \phantom{81 \overline{) 3 \mid 20}} \phantom{0} \phantom{0} \phantom{0} \\ \hline \phantom{81 \overline{) 3 \mid 20}} 3 \mid 77 \end{array}$ <p>Q: 3; R: 77</p>
---

<p><b>Ex.25: 2827÷95</b>          B: 100; C: 5</p> $\begin{array}{r} 95 \overline{) 28 \mid 27} \\ \phantom{95 \overline{) 28 \mid 27}} \phantom{0} \phantom{0} \phantom{0} \\ \hline \phantom{95 \overline{) 28 \mid 27}} 28 \mid 167 \text{ -(a)} \end{array}$	$\begin{array}{r} 95 \overline{) 1 \mid 67} \\ \phantom{95 \overline{) 1 \mid 67}} \phantom{0} \phantom{0} \phantom{0} \\ \hline \phantom{95 \overline{) 1 \mid 67}} 1 \mid 72 \text{ -(b)} \end{array}$	$\begin{array}{r} (a+b) \mid b \\ (28+1) \mid 72 \\ 29 \mid 72 \\ \hline \text{Q: } 29; \text{ R: } 72 \end{array}$
--	--	---

## 2.2 Division using Transpose and Adjust

Sutra: 4. Parāvartya Yojayet (परावर्त्यं योजयेत्)

Meaning: Transpose and Adjust

**Note:** This Sutra is used in division when divisor is above the base (11, 12, 105, 1014 etc.).

First we will understand about Vinculum Numbers.

**Vinculum Number:** A number that has atleast one vinculum digit is called vinculum number. Notation: Either dotted or dash above the number. Note: Here we are using Strikethrough to denote vinculum numbers.

**Ex.**  $1\dot{3}2$ ;  $9\dot{6}81$ ;  $2\dot{2}3$ ;  $6\dot{2}38$ ;  $\dot{8}4$ ;  $2\dot{3}$ ;  $7\dot{3}26$ ;  $\dot{8}$ ;  $\dot{3}$

$$1\dot{3}2 = 100 - 30 + 2 = 72$$

$$9\dot{6}81 = 9000 - 600 - 80 + 1 = 8321$$

$$2\dot{2}3 = 200 + 20 - 3 = 217$$

$$6\dot{2}38 = -6000 + 200 + 30 - 8 = -5778$$

$$\dot{8}4 = -80 + 4 = -76$$

$$2\dot{3} = 20 - 3 = 17$$

$$7\dot{3}26 = 7000 - 300 + 20 - 6 = 6714$$

$$\dot{8} = -8$$

$$\dot{3} = -3$$



## Unit 5: SQUARES

**What is Square:** a square is the result of multiplying a number by itself. For example square of 3 is 9 ( $3 \times 3$ ), square of 12 is 144 ( $12 \times 12$ ), square of -12 is 144 ( $-12 \times -12$ ), square of -45 is 2025 ( $-45 \times -45$ ).

### 5.1 Square Using One More than the Previous One

Sutra: 1. Ekādihikena Pūrvēna

एकाधिकेन पूर्वण

Meaning: One More than the Previous One

**Note:** This sutra is used to obtain square of given number which ends with digit 5 (Ex. 15, 125, 345, 4585, 6485, 9745 etc.).

#### Working Procedure:

1. Split the given number into two parts (left and right) using vertical line (|) or using any other symbol. Right part is last digit i.e 5 and Left part is remaining digits.
2. Multiply left part with its next number. Right part is 25 (Square of 5).
3. Remove vertical line, the obtained number is required square of given number.

<b>Ex.1:15<sup>2</sup></b>	<b>Ex.2:25<sup>2</sup></b>	<b>Ex.3:75<sup>2</sup></b>
1   5	2   5	7   5
1×2   25	2×3   25	7×8   25
2   25	6   25	56   25
<b>225</b>	<b>625</b>	<b>5625</b>

**Ex.3:** Left part is 7 and right part is 5. Multiply 7 with its next number (8). It gives 56. Right part is 25 (square of 5). After removing vertical line we get 5625, which is square of 75.

## 5.2 Square Using Complements/Surpluses

Sub Sutra 7: Yāvadūnam Tāvadūnīkrtya Vargañca Yojayet

Meaning: Lessen by the Deficiency and set up the square of that deficiency.

**Note:** This sutra is used to obtain square of given numbers which are nearer to working (functional) base (Ex 97, 103, 980, 1021 etc).

### Case 1: When Number is below the Working Base.

#### Working Procedure:

1. Note down given number, its base and complement.
2. Make two parts (left and right) using vertical line (|).
3. Right part is square of complement.
4. Left part = (given number – complement).
5. Remove vertical line, the obtained number is required square of given number.

**Note:** After calculating square of right part, number of digits in it should be same as that of zeroes of base. If lesser add required number of zeroes, if greater pass the carry (leftmost excess digits of right part) to left part.

<b>Ex.1: 94<sup>2</sup></b>	<b>Ex.2: 97<sup>2</sup></b>	<b>Ex.3: 87<sup>2</sup></b>	<b>Ex.4: 893<sup>2</sup></b>
Base: 100	Base: 100	B:100; C: -13	B:1000; C:-107
C: -06	C: -03	87-13   -13 <sup>2</sup>	893-107   -107 <sup>2</sup>
94-6   -6 <sup>2</sup>	97-3   -3 <sup>2</sup>	74   169	786   11449
88   36	94   09	74+1   69	786+11   449
<b>8836</b>	<b>9409</b>	75   69	797   449
		<b>7569</b>	<b>797449</b>

## Unit 8: CUBE ROOTS

**Ex.2: Find Cube Root of 580093704**

580: 0 9 3 7 0 4  
192        68; 104; 65; 50; 15; 6  
8; 3; 4; 0; 0; 0

**Answer: 834**

**Ex.3: Find Cube Root of 315821241**

315: 8 2 1 2 4 1  
108        99; 134; 82; 21; 2; 0  
6; 8; 1; 0; 0; 0

**Answer: 681**

**Ex.4: Find Cube Root of 30959144**

30: 9 5 9 1 4 4  
27        3; 12; 8; 16; 5; 6  
3; 1; 4; 0; 0; 0

**Answer: 314**

## Unit 10: DIVISIBILITY

One number is divisible by another number if the result of the division is an integer {and remainder is ZERO}.

**Ex.** 24 is divisible by 6; because  $24 \div 6 = 4$  (Q) and **0** (R).

26 is not divisible by 7; because  $26 \div 7 = 3$  (Q) and **5** (R).

38 is not divisible by 9; because  $38 \div 9 = 4$  (Q) and **2** (R).

### 10.1 Divisible Rules:

**D: Divisor**

D	Rule
1	All integer numbers are divisible by 1.
2	The last digit must be even (0,2,4,6,8)
3	Add digits. The result must be divisible by 3.
4	The last two digits must be divisible by 4.

### 10.2 The Positive Osculators

**Ex.2: 2208 by 23**

Osculator of 23 is 7

$$220 + (8 \times 7)$$

$$220 + 56 = 276$$

--

$$27 + (6 \times 7)$$

$$27 + 42 = 69$$

--

$$6 + (9 \times 7) = 69$$

--

69 is multiple of 23

**So, Divisibility=YES**

**Ex.3: 2457 by 189**

Osculator of 189 is 19

$$245 + (7 \times 19)$$

$$245 + 133 = 378$$

--

$$37 + (8 \times 19)$$

$$37 + 152 = 189$$

--

Result is divisor.

**So, Divisibility=YES**

**10.3 The Negative Osculators****Ex.2: 46046 by 7**

Negative Osculator of 7 is 2

$$4604 - (6 \times 2) = 4592$$

--

$$459 - (2 \times 2) = 455$$

--

$$45 - (5 \times 2) = 35$$

--

$$3 - (5 \times 2) = -7$$

--

Result is -ve of Divisor.

**Divisibility=YES**

# Unit 11: DECIMALS, FRACTIONS AND PERCENTAGES

Decimals, Fractions and Percentages are used to express quantities that are not whole numbers.

**Decimals:** A decimal number contains a decimal point ( . )

**Ex. p.q;** 3.4; 4.6; 789.3; 0.36; 0.00456; -47.3698; -96.67 etc.

**Fractions:** Is an expression that indicates the quotient of two quantities.

**Ex. p/q;**  $1/2$ ;  $1/3$ ;  $42/2.1$ ;  $445.61/2.64$ ;  $785/2$ ;  $36/3$ ;  $-40/20$ ;  $1/-9$  etc.

Upper part is Numerator (N) and Lower part is Denominator. The Denominator can not be zero.

**Percentages:** Per cent means out of 100. Symbol is: %.

**Ex.** 35%; 45%; 0.36%, 134%; 2658% etc

## 11.6 Reciprocals

### 11.6.1 Ending in 9:

**Ex.1:**  $1/19$ ?

**A:** Denominator is 19. Positive Osculator of 19 is 2. (Go through “Divisibility” Unit to understand osculator concept).

$1/19 \approx 1/20 \approx 0.1/2$ ; Now for  $0.1/2$

**D1:**Divisor; **D2:**Divident; **Q:**Quotient; **R:**Remainder

D1	D2	Q	R
2	0.1	-	-
2	1	<b>0.</b>	-
2	10	<b>0</b>	-

2	-	<b>5</b>	0
2	5	<b>2</b>	1
2	12	<b>6</b>	0
2	6	<b>6</b>	0
2	3	<b>1</b>	1
2	11	<b>5</b>	1
2	15	<b>7</b>	1
2	17	<b>8</b>	1
2	18	<b>9</b>	0
2	9	<b>4</b>	1

Divisor is 2 in all cases. Initial Dividend is 0.1. We can not divide 0.1 by 2 so in quotient we need to give decimal point. New Dividend is 1. Again we can not divide 1 by 2 so in quotient we need to add zero. New Dividend is 10. We divide 10 by 2. Q is 5 and R is 0. New Dividend is RQ (05). Remainder and then append Quotient.  $5 \div 2$ ; Q=2; R=1; Next Dividend=12 ( $\because R=1$  &  $Q=2$ ). Like this we go on dividing. Final answer: Quotient Row.

$$1/19=0.052631578....$$

# Unit 12: Introduction to Vedic Speed Mathematics

- Vedic Speed Mathematics is a collection of simple Formulae to solve any mathematical problem (Arithmetic, Algebra, Geometry or Trigonometry) in easy and faster way.
- Vedic Speed Mathematics Consists of 16 Formulae (Aphorisms or Sutras) and 16 Corollaries (Sub-Sutras).
- Vedic Speed Mathematics Originated from Atharva Veda (There are four Vedas; the Rig Veda, Sama Veda, Yajur Veda and Atharva Veda).
- Vedic Speed Mathematics was rediscovered from the Vedas between 1911 and 1918 by Jagadguru Shankaryacharya Sri Bharati Krishna Tirthaji Maharaja (14<sup>th</sup> March 1884 to 2<sup>nd</sup> February 1960; the Shankaryacharya of the Govardhana Matha, Puri, India from 1925 to 1960).

## 12.1 List of Sutras and their Meaning

	Sutra (Formula)	Meaning
1	Ekādhikena Pūrvena (एकाधिकेन पूर्वेण)	One more than the Previous one.
2	Nikhilam Navataścaramam Daśatah (निखिलं नवतश्चरमं दशतः)	All from 9 and the last from 10
3	Ūrdhva – tiryagbhyām (ऊर्ध्वतिर्यग्भ्याम्)	Vertically and Crosswise
4	Parāvartya Yojayet	Transpose and Adjust



	(परावर्त्यं योजयेत्)	
5	Sūnyam Samyasaṁuccaye (शून्यं साम्यसमुच्चये)	If the Samuccay (समुच्चय or समूह or Set) is same, it is ZERO.
6	Ānurūpye Sūnyamanyat (आनुरूप्ये शून्यमन्यत)	If one is in Ratio, the other is ZERO
7	Sankalana - vyavakalanābhyām (संकलनव्यवकलनाभ्याम्)	By Addition and Subtraction
8	Puranāpuranābhyām (पूरणापूरणाभ्याम्)	By the Completion or Non Completion
9	Calanā kalanābhyām (चलनकलनाभ्याम्)	By Calculus
10	Yāvadūnam (यावदूनम्)	By the Deficiency
11	Vyastisamastih (व्यष्टिसमष्टिः)	Individuality & Totality (Part & Whole)
12	Śesānyankena Caramena (शेषाण्यङ्केन चरमेण)	The Remainders by the last Digit
13	Sopantyadvayamantyam (सोपान्त्यद्वयमन्त्यम्)	The Ultimate and twice the Penultimate
14	Ekanyūnena Pūrvēna (एकन्यूनेन पूर्वेण)	By one less than the previous one.
15	Gunitasamuccayah (गुणितसमुच्चयः)	The sum of the product is equal to the product of the sum.
16	Gunakasamuccayah (गुणकसमुच्चयः)	All the Multipliers.

## 12.2 List of Sub Sutras and their Meaning

	Sub Sutra (Corollary)	Meaning
1	Ānurūpyena (आनुरूप्येण)	Proportionately
2	Śisyate Śesamjnah (शिष्यते शेषसंज्ञः)	The Remainder Remains Constant
3	Ādyamādyenantyamantyena (आद्यं आद्येन् अन्त्यम् अन्त्येन)	The First by the First and the Last by the Last
4	Kevalaih Saptakam Gunṛat (केवलैः सप्तकं गुण्यात्)	For 7 the Multiplier is 143
5	Vestanam (वेष्टनम्)	By Osculation
6	Yāvadūnam Tāvadūnam (यावदूनं तावदूनं)	Lessen by the Deficiency
7	Yāvadūnam Tāvadūnikṛtya Vargañca Yojayet (यावदूनं तावदूनीकृत्य वर्गं च योजयेत्)	Lessen by the Deficiency and set up the Square of that Deficiency
8	Antyayordasake' pi (अन्त्ययोर्दशकेऽपि)	When final Digits Added up gives 10
9	Antyayoreva (अन्त्ययोरेव)	Only the Last Terms
10	Samuccayagunitah (समुच्चयगुणितः)	The Sum of the Products
11	Lopanasthāpanabhyām (लोपनस्थापनाभ्यां)	By Alternative Elimination & Retention
12	Vilokanam (विलोकनं)	By Mere Observation
13	Gunitasamuccayah Samuccayagunitah (गुणितसमुच्चयः समुच्चयगुणितः)	The Sum of the Product is equal to the Product of the Sum.

14	Dhvajāñka (ध्वजांक)	On the Flag
15	Śūddha (शुद्धः)	Purification.
16	Dvañdvayoga (द्वन्द्वयोग)	Duplex Combination Process

### 12.3 Sutras: Meaning and Usage

**Note:** Here we will understand meaning and usage of Sutras and Sub Sutras. Their applications are covered in remaining units.

**Sutra 1:** Ekādhikena Pūrvena (एकाधिकेन पूर्वेण):

**Meaning:** One more than the previous one.

**Usage:** To get next number we need to add 1 to the previous number. Suppose number is 78. Its next number is  $78+1=79$ . Number is 876; its next number is  $876+1=877$ .

**Application:** This sutra is used to find the square of a number ending with digit 5.

**Refer Unit:** Squares.

=====

**Sutra 2:** Nikhilam Navataścaramam Daśatah (निखिलं नवतश्चरमं दशतः)

**Meaning:** All from 9 and the last from 10.

**Usage:** This sutra is used to get complement or deficiency of any given number from its working (functional) base.

**Applications:** Subtraction, Multiplication and Division.

**Refer Units:** Subtraction, Multiplication and Division.

Number	Steps	Complement
725	$9-7=2$ $9-2=7$	<b>275</b>

	$10-5=5$	
6800	$9-6=3$ $10-8=2$ $0=0$ $0=0$	<b>3200</b>
7641	$9-7=2$ $9-6=3$ $9-4=5$ $10-1=9$	<b>2359</b>
405	$9-4=5$ $9-0=9$ $10-5=5$	<b>595</b>
78	$9-7=2$ $10-8=2$	<b>22</b>
600	$10-6=4$ $0=0$ $0=0$	<b>400</b>

1. Bases are any positive numbers ending with 0's (zeroes) {Ex. 70, 80, 140, 1300, 5600 etc}. Working (or functional) Base is always power of 10 (Ex. 10, 100, 1000, 10000, 100000 etc).
2. 725: To find complement of 725, subtract all from 9 and the last from 10.
3. 6800: In this case we need to consider 8 as last number and add two zeroes in the end.

=====

**Sutra 3:** Ūrdhva – tiryagbhyām (ऊर्ध्वतिर्यग्भ्याम्)

**Meaning:** Vertically and Crosswise.

**Usage:** This is used to multiply given numbers vertically and crosswise.

**Applications:** to find Product of given numbers and polynomials.

**Refer Units:** Multiplication and Polynomials.

=====

**Sutra 4:** Parāvartya Yojayet (परावर्त्यं योजयेत्)

**Meaning:** Transpose and Adjust.

**Usage and Applications:** This sutra is used in Division Operation (Numbers & Polynomials).

**Refer Units:** Division & Polynomials.

=====

**Sutra 5:** Sūnyam Samyasaduccaye (शून्यं साम्यसमुच्चये)

**Meaning:** If the Samuccay (समुच्चय or समूह or Set) is same, it is ZERO.

**Usage:**

**CASE 1:** In any given equation if any term is common then that term is ZERO.

**Ex.**  $(2x+9) + 7(2x+9) - 3(2x+9) + 6(2x+9) = 0$

{Here  $(2x+9)$  is common in all terms, so  $2x+9=0$ }

**Ex.**  $15x+89x-97x+36x-7x-x=0$  {Here  $x$  is common in all terms, so  $x=0$ }

**CASE 2:** If the products of independent terms are same

**Ex.**  $(x+8)(x+9) = (x+3)(x+4)(x+6)$

{ $x=0$ ;  $\because 8 \times 9 = 72$  and  $3 \times 4 \times 6 = 72$ }

**Ex.**  $(2x-6)(2x+8) = (2x-2)(2x+8)(2x+3)$

{ $2x=0$ ;  $x=0$ ;  $\because -6 \times 8 = -48$  and  $-2 \times 8 \times 3 = -48$ }

**CASE 3:** If the numerical numerators of two fractions are same, then the sum of denominators is ZERO.

**Ex.**  $3/(4x+5) + 3/(7x-3) = 0$

Here  $3=3$ ; so  $4x+5+7x-3=0$ ;

$11x+2=0$ ;  $11x=-2$ ;  $x=-2/11$ .

**Ex.**  $-7/x^2+6 + -7/6x+3 = 0$

Here  $-7=-7$ ; so  $x^2+6+6x+3=0$ ;

$x^2+6x+9=0$ ;  $(x+3)^2=0$ ;  $x= -3$ .

**Ex.**  $16/3x+5 - 16/8x-12 = 0$

$16=16$ ; so  $3x+5-(8x-12)=0$ ;  $3x+5-8x+12=0$ ;  $-5x+17=0$ ;  $x= 17/5$ .

**Note:** Here sign is negative, so we have subtracted (D1-D2)

**CASE 4:**

• If  $N1+N2=D1+D2$  then  $N1+N2=D1+D2=0$

$(3x+5) / (5x+4) = (4x+6) / (2x+7)$

$N1+N2 = (3x+5) + (4x+6) = \mathbf{7x+11}$ ;

$D1+D2 = (5x+4) + (2x+7) = \mathbf{7x+11}$

$\therefore 7x+11=0$ ;

$\mathbf{x = - 11/7}$

• If  $m(N1+N2)=n(D1+D2)$  then  $N1+N2=D1+D2=0$

(**m,n**=common factors)

$(7x+2) / (2x+1) = (5x+6) / (x+1)$

$7x+2+5x+6=\mathbf{12x+8=4(3x+2)}$

$2x+1+x+1=\mathbf{3x+2=1(3x+2)}$

$\therefore 3x+2=0$

$\mathbf{x = -2/3}$

• If  $m(N1-D1)=n(N2-D2)$  then  $N1-D1=N2-D2=0$  (**m,n**=common factors)

$(3x+5) / (5x+4) = (4x+6) / (2x+7)$

$3x+5-5x-4= -2x+1$  and  $4x+6-2x-7= 2x-1 = -1 (-2x+1)$

$\therefore -2x+1=0$ ;  $2x=1$ ;

$\mathbf{x = 1/2}$

**CASE 5:** If the expressions are same, then their differences are ZERO.

**Ex.**  $(a-b)^2$  and  $(a^2-2ab+b^2)$  are same. So  $(a-b)^2 - (a^2-2ab+b^2) = 0$ .

**Application:** Solving Simple and Quadratic Equations.

**Refer Units:** Simple & Quadratic Equations

=====

**Sutra 6:** (Ānurūpye) Śūnyamanyat (आनुरूप्ये) शून्यमन्यत्

**Meaning:** If one is in ratio, the other is ZERO

**Application:** Solving Simultaneous Equations.

**Usage:**

General Form:  $a_1x+b_1y=c_1$  and  $a_2x+b_2y=c_2$ ;

if  $b_1:b_2 = c_1:c_2$  then  $x=0$  and

if  $a_1:a_2 = c_1:c_2$  then  $y=0$

**Ex:** Solve  $7x+5y=60$  and  $42x+30y=360$

$a_1:a_2=7:42=1:6$

$c_1:c_2=60:360=1:6$

$\therefore y = 0$ ;

Put  $y=0$  in any of the above equations

$7x+0=60$ ;

$x = 60/7$

**Ex:** Solve  $5x+14y=75$  and  $9x+42y=225$

**A:**

$b_1:b_2=14:42=1:3$

$c_1:c_2=75:225=1:3$

$\therefore x = 0$ ;

$14y=75$ ;

$y = 75/14$

=====

**Sutra 7:** Sankalana – vyavakalanābhyām (संकलनव्यवकलनाभ्याम्)

**Meaning:** By Addition and Subtraction.

**Usage:** This sutra is applicable when coefficients of variables are found interchanged OR adding and subtracting given equation simplifies given equations.

**Application:** Solving Simultaneous Equations and in finding HCF.

**Refer Units:** Simultaneous Equations and HCF.

=====

## 12.4 Sub Sutras: Meaning and Usage

**Sub Sutra 1:** Ānurūpyena (आनुरूप्येण)

**Meaning:** Proportionately

**Usage:** This sutra is used to

- find square and cube of two or three digits number.
- Solve simple quadratic equations and simultaneous equations.
- Express any number as the sum or the difference of squares of two numbers.

**Refer Units:** Squares, Cubes, Quadratic and Simultaneous Equations.

=====

**Sub Sutra 6:** Yāvadūnam Tāvadūnam (यावदूनं तावदूनं)

**Meaning:** Lessen by the Deficiency

**Usage:** This sutra is used to find Cube of a given number.

**Refer Unit:** Cubes.

=====

**Sub Sutra 7:** Yāvadūnam Tāvadūnīkrtya Vargañca Yojayet (यावदूनं तावदूनीकृत्य वर्गं च योजयेत्)

**Meaning:** Lessen by the Deficiency and set up the square of that deficiency.

**Usage:** This sutra is used to find Square of a given number.

**Refer Unit:** Squares.

=====



**Sub Sutra 14:** Dhvajānka (ध्वजांक)

**Meaning:** On the flag

**Usage:** This sutra is used in division operation.

**Refer Unit:** Division.

=====

**Sub Sutra 15:** Śūddha (शुद्धः)

**Meaning:** Purification.

**Usage:** This sutra is used to add and subtract given numbers.

**Refer Units:** Addition and Subtraction.

=====

# TRANSFORMING INDIA AND MISSION WORLD PEACE

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- **Bosom Buddy Crew Concept:** How to effectively utilize the Strengths, Skills and Services of Youths for the fast Development of Entire Universe in all Sectors.
- Farmers: Challenges and Solutions.
- Ground Level Study Report on "Engineering and Higher Education System"; Challenges and Easy Solutions.
- Women Empowerment
- Technological Unemployment
- **Vedic Mining (Why to reinvent when everything is already invented?)**
- Working Culture
- Rural Development
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- **IMP: If you know any celebrities; ask them to go through .con Project, make a team of like minded people and successfully implement .con Project for the welfare of entire universe.**

**Thanks & Regards,**

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