

# LEVEL 1

Vedic maths is based on 16 sutras or principles. These principles are generally in nature and can be applied in many ways. 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 for more systematic than the modern system.

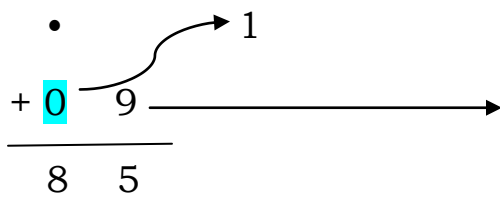
Introduction to 9 compliment	Introduction to 10 compliment
9 - 0	9 - 1
8 - 1	8 - 2
7 - 2	7 - 3
6 - 3	6 - 4
5 - 4	5 - 5
4 - 5	4 - 6
3 - 6	3 - 7
2 - 7	2 - 8
1 - 8	1 - 9
0 - 9	

## RAPID ADDITION

**NOTE: FRIEND IS CHOSEN**

**Whenever direct addition is not possible**

1. 7 6

$$\begin{array}{r} \cdot \\ + 09 \\ \hline 85 \end{array}$$


Take friend of 9 = 1 and subtract from 6 = 5.

Whenever friend is chosen, put a dot above the previous number which shows the value of number is increased by 1.

2.

$$\begin{array}{r}
 4\ 3\ 4\ 7 \\
 \cdot\ \cdot\ \cdot \\
 \hline
 2\ 6\ 9\ 6 \\
 \hline
 7\ 0\ 4\ 3 \\
 \hline
 \end{array}$$

$\bullet (4) = 7 - 4 = 3$   
 $\bullet (9) = 10 = 0 + 4 = 4$   
 $\bullet (6) = 7(3) = 3 - 3 = 0$   
 $\bullet (2) = 3 + 4 = 7$  (direct addition)

### RAPID SUBTRACTION

**NOTE: FRIEND IS CHOSEN**

**Whenever direct subtraction is not possible**

1.

$$\begin{array}{r}
 4\ 7 \\
 \cdot \\
 -\ 0\ 9 \\
 \hline
 3\ 8 \\
 \hline
 \end{array}$$

Take friend of 9 = 1 and add to 7 = 8.

Whenever friend is chosen, put a dot above the previous number which shows the value of number is increased by 1.

2.

$$\begin{array}{r}
 4\ 3\ 4\ 7 \\
 \cdot\ \cdot \\
 -\ 2\ 6\ 9\ 6 \\
 \hline
 1\ 6\ 5\ 1 \\
 \hline
 \end{array}$$

$7 - 6 = 1$  (direct sub)  
 $9 (1) = 4 + 1 = 5$   
 $\bullet (6) = 7(3) = 3 + 3 = 6$   
 $\bullet (2) = 3 = 4 - 3 = 1$  (direct subtraction)

## **MULTIPLICATION BY 5**

$$486 \times 5$$

$$\begin{array}{r} 4860 \div 2 \\ \hline 2430 \end{array}$$

$$5 = 10 \div 2$$

**NOTE:** Insert 0 to the end of the number and divide by 2.

## **MULTIPLICATION BY 25**

$$8564 \times 25$$

$$\begin{array}{r} 856400 \div 4 \\ \hline 214100 \end{array}$$

$$25 = 100 \div 4$$

**NOTE:** Insert 00 to the end of the number and divide by 4.

## **MULTIPLICATION BY 125**

$$6342 \times 125$$

$$\begin{array}{r} 6342000 \div 8 \\ \hline 792750 \end{array}$$

$$125 = 1000 \div 8$$

**NOTE:** Insert 000 to the end of the number and divide by 8.

## Sutra

### Anthyordashakepi

**NOTE:** Last digits adding up to 10.

To multiply the numbers where the last digits add up to 10 and the previous digits are same.

$$\begin{array}{l} \text{48 x 42} \\ \text{4 x 5/8 x 2 - Sutra} \\ \text{Sutra} \end{array} \quad \begin{array}{l} \text{(Multiplying the friends)} \\ \text{First digits are same.} \\ \text{Last digits are} \\ \text{compliments of 10.} \end{array}$$
$$20/16 \quad = \quad 2016$$

If the first digits are same, apply sutra i.e., 4 X 5 becomes 20.  
Then, again apply sutra.

1) 97 X 93

2) 86 X 84

3) 79 X 71

4) 109 X 101

5) 10.9 X 10.1

5) 39.7 X 39.3

7) 11.8 X 11.2.

1.  $97 \times 93$   
 $9 \times 10/7 \times 3$   
9021

2.  $86 \times 84$   
 $8 \times 9/6 \times 4$   
7224

3.  $79 \times 71$   
 $7 \times 8/9 \times 1$   
569

4.  $109 \times 101$   
 $10 \times 11/09 \times 1$   
11009

5.  $10.9 \times 10.1$   
 $109 \times 101$   
 $10 \times 11/9 \times 1$   
11.09

6.  $39.7 \times 393$   
 $397 \times 393$   
 $39 \times 40 / 7 \times 3$   
156021

7.  $11.8 \times 11.2$   
 $11 \times 12 / 8 \times 2$   
 $132 / 16$   
13216

8.  $19.96 \times 19.94$   
 $199 \times 200 / 24$   
398.0024

**AMAZING MULTIPLICATION**

Sum of first digit being 10 and last digit being the same.

1.  $11 \times 91$   


---

 $1 \times 9 / 1 \times 1$   
 $9 / 01$   


---

 $+1 \longrightarrow$  (last digit of 11 and 91 ie similar digits )  


---

1001

$$\begin{array}{r}
 2. \quad 77 \quad \times \quad 37 \\
 \hline
 7 \times 3 \quad / \quad 7 \times 7 \\
 21 \quad / \quad 49 \\
 +7 \\
 \hline
 2849
 \end{array}$$

### DIVISION BY 5

$$2430 \div 5$$

$$\div 5 = \times 2 \div 10$$

$$2430 \times 2$$

**NOTE:** Multiply by 2. Strike out 0 at the end.

$$486\cancel{0}$$


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$$486$$

### DIVISION BY 25

$$214100 \div 25$$

$$\div 25 = \times 4 \div 100$$

$$214100 \times 4$$

**NOTE:** Multiply by 4. Strike out 00 at the end.

$$8564\cancel{00}$$


---

$$8564$$

### DIVISION BY 125

$$79250 \div 125$$

$$125 = \times 8 \div 1000$$

$$79250 \times 8$$

**NOTE:** Multiply by 8. Strike out 000 at the end.

$$634\cancel{000}$$


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$$634$$

# LEVEL 2

## Multiplication of any number by 11

1.  $23 \times 11$

0 2 3 0  
   $\swarrow$   $\searrow$

253

2.  $11 \times 11$

0 1 1 0  
   $\swarrow$   $\searrow$

121

3.  $782 \times 11$

0 7 8 2 0  
   $\swarrow$   $\searrow$   $\searrow$

8602

Omit 11

Add 0 to front and back  
of the number.

Add numbers  
consequently from right  
to left.

i.e.  $0 + 3 = 3$

$3 + 2 = 5$

$2 + 0 = 2$



## MULTIPLICATION OF 22, 33 .....

(22 = 11 X 2, 33 = 11 X 3)

1.  $782 \times 22$

$$782 \times 11$$

$$\begin{array}{r} 07820 \\ \swarrow \searrow \swarrow \searrow \swarrow \searrow \end{array}$$

$$8602 \times 2$$

$$\underline{17204}$$

### Multiplication by 12, 13, 14 upto 19

**NOTE:-** Multiply the previous, add the next.

Example:-  $24 \times 12$

$$24 \times 12 = 288$$

$$\underline{0240 \times 12}$$

$$\underline{0240 \times 2}$$

$$\underline{288}$$

Omit 12 and take 2, 3, 4, 5, 6. Take 2 digits from right side and multiply by 2, or 3 and add the next.

$$\begin{array}{r} \swarrow \searrow \\ 40 \times 2 = 8 \end{array}$$

$$\begin{array}{r} \swarrow \searrow \\ 24 \times 2 = 4 + 4 = 8 \end{array}$$

$$\begin{array}{r} \swarrow \searrow \\ 02 \times 2 = 0 + 2 = 2 \end{array}$$

1.  $2763 \times 12$

$$\underline{027630 \times 2}$$

$$\underline{33156}$$

2.  $715 \times 16$   
 $07150 \times 6$   
11440

3.  $8761 \times 18$   
 $087610 \times 8$   
157698

Multiplication by 21, 31, 41, upto 91

**NOTE**:- Multiply the next, add the previous.

1.  $312 \times 21$   
 $03120 \times 2$   
6552

2.  $7358 \times 41$   
 $073580 \times 4$   
301678

Sutra – Nikilam nava tascharamam dashathaha

If multiplier and multiplicand are of same base numbers

All by 9, last by 10

Applied in multiplication of numbers nearest to base numbers

- |    | Case 1        | Below base number |   |
|----|---------------|-------------------|---|
| 1. | 942 X 998     | – 1000            |   |
|    | 942 – 058     | 940               |   |
|    | 998 – 002     | = 940             | Crosswise subtract,<br>multiply the difference. |
|    | <hr/>         |                   |   |
|    | 940/116       |                   |   |
|    | <u>940116</u> |                   |   |
| 2. | 8.9 X 9.7     | – 100             |   |
|    | 89 – 11       | – 86              |   |
|    | 97 – 03       | = 86              |   |
|    | <hr/>         |                   |   |
|    | 86/33         |                   |   |
|    | <u>86.33</u>  |                   |   |
| 3. | 7.5 X 9.6     | – 100             |   |
|    | 75 – 25       | 71                |   |
|    | 96 – 04       | = 71              |   |
|    | <hr/>         |                   |   |
|    | 71/100        |                   |   |
|    | <u>72.00</u>  |                   |   |

4. 99432 X 99989 1,00,000

$$\begin{array}{r} 99432 - 568 \\ 99989 - 11 = 99421 \end{array}$$

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99421 / 06248

9942106248

568 X 11

0 5 6 8 0

6248

5. 88 X 87 - 100

$$88 - 12 = 75$$

$$87 - 13 = 75$$

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75 / 156

7656

**Case - II** Above base number

1. 106 X 115 - 100

$$\begin{array}{r} 106 - 6 \\ 115 - 15 = 121 \end{array}$$

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121 / 90

12190

**NOTE:-** Crosswise add

$$2. \quad 12.38 \times 1.004 \quad - 1000$$

$$\begin{array}{r}
 1238 - 238 \\
 1004 - 004 \quad = 1242 \\
 \hline
 1242 / 952 \\
 \hline
 \underline{1242952}
 \end{array}$$

- Ex:- (1)  $948 \times 991$       (2)  $96.3 \times 994$       (3)  $101 \times 109$   
  (4)  $1004 \times 1007$     (5)  $100.58 \times 10.012$     (6)  $17.2 \times 10.8$   
  (7)  $6.3 \times 6.7$

$$1. \quad 948 \times 991 \quad 1000$$

$$\begin{array}{r}
 948 - 52 \\
 991 - 9 \quad = 939 \\
 \hline
 939 / 468 \\
 \hline
 \underline{939468}
 \end{array}$$

$$2. \quad 96.3 \times 99.4 \quad 1000$$

$$\begin{array}{r}
 963 \times 994 \\
 963 - 37 \\
 994 - 06 \quad = 957 \\
 \hline
 957 / 222 \\
 \hline
 \underline{957222}
 \end{array}$$

$$3. \quad 101 \times 109 \quad - 100$$

$$101 - 1$$

$$109 - 9 = 110$$

---

$$110 / 09$$

$$\underline{11009}$$

$$4. \quad 1004 \times 1007 \quad 1000$$

$$1004 - 4$$

$$1007 - 7 = 1011$$

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$$1011 / 028$$

$$\underline{1011028}$$

$$5. \quad 100.58 \times 10.012$$

$$10058 \times 10012 \quad - 10000$$

$$10058 - 58$$

$$10012 - 12 = 10070$$

---

$$10070 / 0696$$

$$\underline{100700696}$$

$$6. \quad 17.2 \times 10.8 \quad - 100$$

$$172 \times 108$$

$$172 - 72$$

$$108 - 08 = 180$$

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$$180 / 576 = \underline{18576}$$

7.  $6.3 \times 6.7$  100

$$\left. \begin{array}{l} 63 - 37 \\ 67 - 33 \end{array} \right\} = 30$$

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30 / 1221

4221

37 X 33 Refer sutra III.

3 x 4 / 7 x 3

1221

### AMAZING DIVISION

(Nearest base number)

1.  $1123 \div 112$

Above base number 100

112	1 1 / 2 3
12	- 1 - 2
	0 0
	1 0 / 0 3

Q = 10, R = 3

Divisor = 12 (100 + 12) (more number).

1. Write the first digit as it is (1) = Q.
2. Multiply the Q with the divisor 12 (1 X 12 = 12).
3. Subtract, therefore 1 - 1 = (0) = Q.
4. Repeat steps 2 and 3.

**HINT:** Split the number (1123, Q and R) as 11/23 (since base number is 12).

2.  $2426 \div 99$

Below base number 100

$$\begin{array}{r}
 99 \overline{) 2426} \\
 \underline{0102} \phantom{00} \\
 \phantom{0}04 \phantom{00} \\
 \underline{\phantom{0}24} \phantom{00} \\
 \phantom{00}50
 \end{array}$$

Q = 24, R = 50

Divisor = 0 1 (100 - 1) (less number).

1. Write the first digit as it is (2) = Q.
2. Multiply the Q with the divisor 0 1 (0 1 X 2 = 0 2).
3. Add, therefore 4 - 0 = (4) = Q.
4. Repeat steps 2 and 3.

**HINT:** Split the number (2426, Q and R) as 24/26 (since base number is 01).

**AMAZING DIVISION BY 12, 13, 14 ..... up to 100**

1.  $55068 \div 12$

$$\begin{array}{r}
 55068 \\
 \underline{\phantom{0}00} \\
 50062
 \end{array}$$

	Q	R
$5 \div 1$	5	(0)
$5 - 5$	$0 \div 1$	(00)
$0 - 0$	$0 \div 1$	0 (0)
$6 - 0$	$6 \div 1$	6 (0)
$8 - 6$	$2 \div 1$	2 (0)

2.  $55068 \div 12$

$$\begin{array}{r}
 55068 \\
 \underline{\phantom{0}00} \\
 4589
 \end{array}$$

	Q	R
$5 \div 1$	4	(1)
$15 - 8$	$7 \div 1$	5 (2)
$20 - 10$	$10 \div 1$	8 (2)
$26 - 16$	$10 \div 1$	9 (1)
$18 - 18$	0	0



3. 15072

$$\begin{array}{r}
 \text{DM} \\
 \div 12 \\
 \hline
 1256
 \end{array}$$

D = Divide

M = Multiply

$1 \div 1$	1
$1 \times 2$	2
$5 - 2$	$3 \div 1$
$3 \div 1$	2
$10 - 4$	$6 \div 1$
$6 \div 1$	$1 \times 5 = 5$
$17 - 10$	7
$7 \div 1$	$1 \times 6 = 6$

4. 134013

$$\begin{array}{r}
 \div 31 \\
 \hline
 4323
 \end{array}$$

14	10	11
$-4$	$-3$	$-2$
$\hline 10 \div 3 (1)$	$\hline 7 \div 3$	$\hline 9 \div 3$
$\hline 3$	$\hline 2 (1)$	$\hline 8$
	3	
	$\hline -3$	
	0	

$$\begin{array}{r}
 5. \quad 186887 \\
 \quad \div 31 \\
 \hline
 6027
 \end{array}$$

$$\begin{array}{r}
 4. \quad 22367676 \\
 \hline
 721536
 \end{array}$$


$$\begin{array}{r}
 5. \quad 19447695 \div 31 \\
 19447695 \\
 \quad \div 31 \\
 \hline
 627345
 \end{array}$$

		Q R
	$19 \div 3$	6 (1)
$14 - 6$	$8 \div 3$	2 (2)
$24 - 2$	$22 \div 3$	7 (1)
$17 - 7$	$10 \div 3$	3 (1)
$16 - 3$	$13 \div 3$	4 (1)
$19 - 4$	$15 \div 3$	5 (0)
$5 - 5$	0	

$$\begin{array}{r}
 6. \quad 25121656 \div 31 \\
 25121656 \\
 \quad \div 31 \\
 \hline
 810376
 \end{array}$$

		Q R
	$25 \div 3$	8 (1)
$11 - 8$	$3 \div 3$	1 (0)
$2 - 1$	$1 \div 3$	0 (1)
$11 - 0$	$11 \div 3$	3 (2)
$26 - 3$	$23 \div 3$	7 (2)
$25 - 7$	$18 \div 3$	6 (0)

7.  $189627 \div 31$

$$\begin{array}{r} 189627 \\ \div 31 \\ \hline 6117 \end{array}$$

		Q	R
	$18 \div 3$	6	(0)
$9 - 6$	$3 \div 3$	1	(0)
$6 - 1$	$5 \div 3$	1	(2)
$22 - 1$	$21 \div 3$	7	(0)
$7 - 7$	0		

8.  $2269527732 \div 31$

$$\begin{array}{r} 2269527732 \\ \div 31 \\ \hline 73210572 \end{array}$$

		Q	R
	$22 \div 3$	7	(1)
$16 - 7 \text{ X } 1$	$9 \div 3$	3	(0)
$9 - 3 \text{ X } 1$	$6 \div 3$	2	(0)
$5 - 2 \text{ X } 1$	$3 \div 3$	1	(0)
$2 - 1 \text{ X } 1$	$1 \div 3$	0	(1)
$17 - 0 \text{ X } 1$	$17 \div 3$	5	(2)
$27 - 5 \text{ X } 1$	$22 \div 3$	7	(1)
$13 - 7 \text{ X } 1$	$6 \div 3$	2	(0)
$2 - 2 \text{ X } 1$	0		

# LEVEL 3

## DIGITAL ROOT ADDITION

1.  $35 = 3 + 5 = 8$

2.  $86 = 8 + 6 = 14 = 1 + 4 = 5$

3.  $825143 = 8 + 2 + 5 + 1 + 4 + 3 = 23 = 2 + 3 = 5$

## DIGITAL ROOT BY CASTING OUT 9

1.  $\cancel{4}8\cancel{5} = 8$  ( $5 + 4 = 9$ , therefore 4 and 5 are striked out).

2.  $\cancel{4}\cancel{8}\cancel{5}\cancel{1}24 = 6$  ( $4 + 5 = 9$ ,  $8 + 1 = 9$ )

3.  $\cancel{1}\cancel{8}0\cancel{9} = 9$  ( $1 + 8 = 9$ )

SUTRA:- Ek nyunena purvena

**Meaning:**-One less than the previous number.

Multiplying a number by 9, 99, 999 ..... etc

Ex:-            78 x 99

<p><b><u>NOTE:</u></b>-(L.H.S = R.H.S number of digits)</p>
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**Case I**

1.    77/22                    subtract the one less number from 99  
      = 7722

2.    755 X 999  
      755/244  
      755244

3.    1.23 X 99.9  
      123 X 999  
      122/877  
      1222877

4.    13046 X 999.99  
      13045/86954  
      1304586954

5.  $607.25 \times 99.999$   
 $60724/39275$   
 $6072439275$

**Case II**

**NOTE**:-L.H.S < R.H.S.

1)  $53 \times 999$   
 $053 \times 999$   
 $052/947$   
 $52947$

Add one zero to LHS

2)  $5846 \times 99999$   
 $05845/941554$   
 $5845941554$

3)  $8.42 \times 9.999$   
 $0842 \times 9.999$   
 $0842/0158$   
 $8420158$

### Case – III

**NOTE**:-L.H.S > R.H.S

1.  $175 \times 99$

$$174/25$$

$$\underline{17325}$$

Take compliment for last 2 digits of LHS or the first digit. Subtract one from the left digit (i.e.  $174 - 1 = 173$ )

2.  $872 \times 99$

$$871 - 8/28$$

$$\underline{86328}$$

3.  $13675 \times 999$

$$13674 - 13/325$$

$$\underline{13661325}$$

Example sums:- (Test sums)

1.  $10.9 \times 9.99$

2.  $3648 \times 99$

3.  $895 \times 999$

1.  $10.9 \times 9.99$

$$108/891$$

$$\underline{108.891}$$

2.  $3648 \times 99$

$$3647 - 36/52$$

$$\underline{361152}$$

3.  $895/999$

$$= 894/105$$

$$\underline{894105}$$


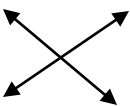
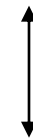


Sutra - 7

**URDHVA TRIYAKHBYAM (VERTICALLY CROSSWISE)**


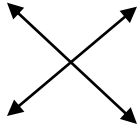
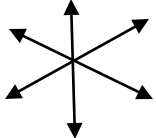
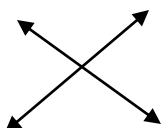

1.  $53 \times 34$

$$\begin{array}{r} 53 \\ 34 \\ \hline 15 / 219 / 12 \\ \\ = 1802 \end{array}$$

1.		$3 \times 4 = 12$
2.		$5 \times 4 + 3 \times 3 = 20 + 9 = 29$
3.		$5 \times 3 = 15$

2.  $974 \times 19$

$$\begin{array}{r} 974 \\ 019 \\ \hline 0 / 9 / 818 / 617 / 36 \\ \\ \underline{18506} \end{array}$$

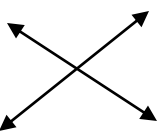
1.		$4 \times 9 = 36$
2.		$9 \times 7 + 4 \times 1 = 67$
3.		$9 \times 9 + 4 \times 0 + 7 \times 1 = 88$
4.		$9 \times 1 + 7 \times 0 = 9$
5.		$9 \times 0 = 0$

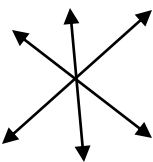
3. 1243 X 1211

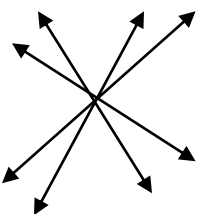
$$\begin{array}{r}
 1243 \\
 1211 \\
 \hline
 1 / 4^1 / 9 / 14 / 12 / 7 / 3
 \end{array}$$

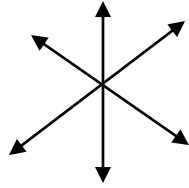
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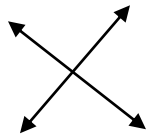
1.   $3 \times 1 = 3$

2.   $4 \times 1 + 3 \times 1 = 7$

3.   $2 \times 1 + 3 \times 2 + 4 \times 1 = 12$

4.   $1 \times 1 + 3 \times 1 + 2 \times 1 + 4 \times 2 = 14$

5.   $4 \times 1 + 1 \times 1 + 2 \times 2 = 9$

6.   $2 \times 1 + 2 \times 1 = 4$

7.   $1 \times 1 = 1$

$1 \times 1 = 01$
$2 \times 1 = 02$
$3 \times 1 = 03$
$4 \times 1 = 04$
$5 \times 1 = 05$
$6 \times 1 = 06$
$7 \times 1 = 07$
$8 \times 1 = 08$
$9 \times 1 = 09$
$10 \times 1 = 10$

## Compulsory as speed writing

	1	2	3	4	5	6	7	8	9
1	01	02	03	04	05	06	07	08	09
2	02	04	06	08	10	12	14	16	18
3	03	06	09	12	15	18	21	24	27
4	04	08	14	16	20	24	28	32	36
5	05	10	15	20	25	30	35	40	45
6	06	12	18	24	30	36	42	56	63
7	07	14	21	28	35	42	49	56	63
8	08	16	24	32	40	48	56	64	72
9	09	18	27	36	45	54	63	72	81

Sutra – Yavadhoonam thavadhoone krithva vargancha yojayeth

**Meaning:-**How much it is less, so much it is lessen and the square of the difference is taken.

**Applied in:** Squaring of numbers nearest to the base numbers i.e., 100, 1000, 10000 etc.

### Case – 1

**NOTE:-** Below the base numbers

Example  $(96)^2$

Base number            100

$$100 - 96 = 4$$

$$96 - 4 = 92$$

How much it is less than base number, square of the same is taken.

1.  $(96)^2$

$$96 - 4/4^2$$

$$\underline{9216}$$

2.  $(99)^2$

$$99 - 1/1^2$$

$$\underline{9801}$$

3.  $(98)^2$

$$98 - 2/2^2$$

$$\underline{9604}$$

4.  $(89)^2$

$$89 - 11/11^2$$

$$78/121$$

∨

$$\underline{7921}$$

The number of digits in right part should be in equal to the number of zeroes in base number. If it is more 1 or 2 carry on the digit to the left part and add.

5.  $(85)^2$

$$85 - 15/15^2$$

$$70/225$$

$$\swarrow$$
$$\underline{7225}$$

6.  $(9987)^2 - (10000)$

$$9987 - 3/3^2$$

$$9984/0009$$

$$\underline{99840009}$$

7.  $(99.992)^2$

$$99992 - 100000$$

$$99992 - 8/8^2$$

$$99984/00064$$

$$\underline{9998.400064}$$

8.  $(988)^2 - 1000$

$$988 - 12/12^2$$

$$976/144$$

$$\swarrow$$
$$\underline{976144}$$

Case – 2

**NOTE**:- Above base number

Ex:-  $(108)^2$

How much it is more, so much it is added and the square of the more number is taken.

1.  $108 + 8/8^2$

$116/64$

$11664$

2.  $(100.013)^2$

$(100013)^2 - 100000$

$100013 + 13/13^2$

$100026/00169$

$10002.600169$

(1)  $(94)^2$

(2)  $(10.14)^2$

(3)  $(8.7)^2$

(4)  $(11.1)^2$

(5)  $(1018)^2$

(6)  $(999.93)^2$

(7)  $(10015)^2$

$$1. \quad (94)^2 \quad - \quad 100$$

$$94 - 6/6^2$$

$$88/36$$

$$\underline{8836}$$

$$2. \quad (10.14)^2$$

$$(1014)^2 \quad - \quad 1000$$

$$1014 + 14/14^2$$

$$1028/196$$

$$\underline{1028196}$$

$$3. \quad (87)^2 \quad - \quad 100$$

$$(87)^2$$

$$87 - 8/8^2 \quad = \quad \underline{7964}$$

$$4. \quad (11.1)^2$$

$$111 - 100$$

$$111 + 11/11^2$$

$$122/121$$

$$\underline{123.21}$$



5.  $(1018)^2 - 1000$

$$1018 + 18/18^2$$

$$1036/324$$

$$\underline{1036324}$$

6.  $(999.93)^2$

$$99993 \qquad 100000$$

$$99993 - 7/7^2$$

$$99986/49$$

$$\underline{999860.0049}$$

7.  $(10015)^2 - 10000$

$$10015 + 15/15^2$$

$$10030/225$$

$$\underline{100300225}$$

## SQUARE ROOTS

(Applicable up to 6 digits)

1 to 9 square speed writing

NUMBERS	SQUARE VALUE
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81

1.  $\sqrt{121}$

$$\begin{array}{r} 11 \\ 1 \overline{) 121} \\ \underline{1} \phantom{0} \\ 21 \phantom{0} \\ \underline{21} \\ 0 \end{array}$$

**11**

2. 
$$\begin{array}{r} 31 \\ 3 \overline{) 961} \\ \underline{9} \phantom{1} \\ 61 \\ \underline{61} \\ 0 \end{array}$$
 **31**

3. 
$$\begin{array}{r} 82 \\ 8 \overline{) 6724} \\ \underline{64} \phantom{4} \\ 324 \\ \underline{324} \\ 0 \end{array}$$
 **82**

4. 
$$\begin{array}{r} 76 \\ 7 \overline{) 5776} \\ \underline{49} \phantom{6} \\ 876 \\ \underline{876} \\ 0 \end{array}$$
 **76**

5. 
$$\begin{array}{r} 32 \\ 3 \overline{) 1024} \\ \underline{9} \\ 124 \\ \underline{124} \\ 0 \end{array}$$
 **32**

6. 
$$\begin{array}{r} 95 \\ 9 \overline{) 9025} \\ \underline{81} \\ 925 \\ \underline{925} \\ 0 \end{array}$$
 **95**

7. 
$$\begin{array}{r} 564 \\ 5 \overline{) 318096} \\ \underline{25} \\ 106 \\ \underline{680} \\ 636 \\ \underline{4496} \\ 4496 \\ \underline{0} \end{array}$$
 **564**

## ALGEBRIC POLYNOMIALS

$$1 (5a + 3b) \times (3a + 4b)$$

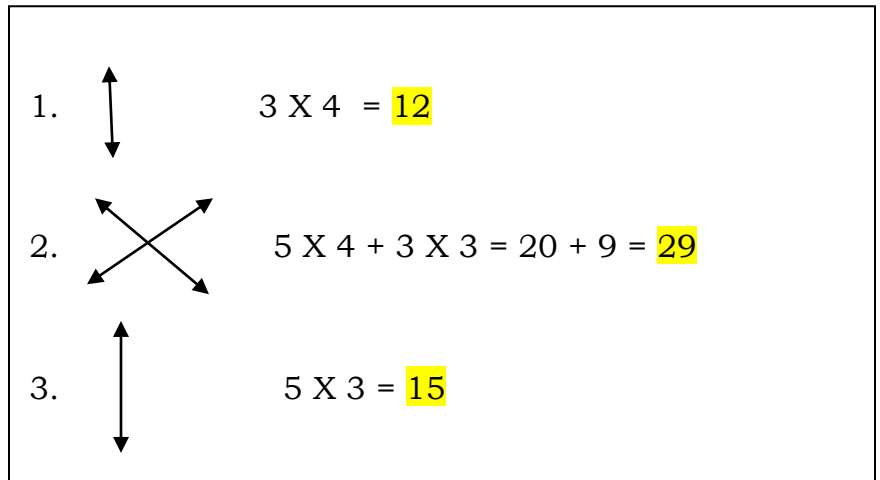
$5a + 3b$           Coefficients of a and b are taken.

$$3a + 4b$$

$$53 \times 34$$

$$\begin{array}{r} 53 \\ \times 34 \\ \hline 15 \quad 29 \quad 12 \end{array}$$

$$\mathbf{15a^2 + 29ab + 12b^2}$$



$$(9a^2 + 7a + 4) \times (a + 9)$$


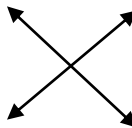
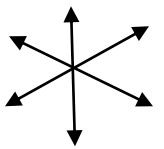
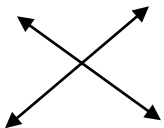

$$974 \times 19$$

$$9 \ 7 \ 4$$

$$\underline{0 \ 1 \ 9}$$

$$0 \ / \ 9 \ / \ 88 \ / \ 67 \ / \ 36$$

$$9a^3 + 88a^2 + 67a + 36$$

1.		$4 \times 9 = 36$
2.		$9 \times 7 + 4 \times 1 = 67$
3.		$9 \times 9 + 4 \times 0 + 7 \times 1 = 88$
4.		$9 \times 1 + 7 \times 0 = 9$
5.		$9 \times 0 = 0$

# LEVEL 4

## FRACTIONS

Simplify and convert to mixed fraction, common denominators

Ex:-

$$\begin{array}{l} \text{L} \quad \text{R} \\ \frac{8}{13} + \frac{11}{13} = 1 \frac{6}{13} \end{array}$$

$$1. \quad 5 \frac{6}{7} + \frac{5}{7} = 6 \frac{4}{7}$$

$$2. \quad 52 \frac{7}{12} + 13 \frac{11}{12} \\ 66 \frac{6}{12}$$

### NOTE:

1. First, find the difference of numerator and denominator of right part, i.e.,  $(13 - 11 = 2)$ .

2. Subtract this difference from the numerator of the left part i.e.,  $(8 - 2 = 6)$ . Consider whole part as 0 and add one as per the rule i.e.,  $(0 + 1 = 1)$

$$1 \frac{6}{13}$$

$$7 - 5 = 2 = \text{difference}$$

$$6 - 2 = 4 = \text{numerator}$$

$$5 + 1 = 6 = \text{whole}$$

$$12 - 11 = 1$$

$$7 - 1 = 6 \quad - \text{Numerator}$$

$$52 + 13 + 1 = 66$$

$$3. \quad 212 \frac{187}{256} + 104 \frac{245}{256}$$

$$317 \frac{176}{256}$$

$$256 - 245 = 11$$

$$187 - 11 = 176 \text{ - Numerator}$$

$$212 + 104 + 1 = 317$$

## FRACTION SUBTRACTION

$$8 - \frac{7}{12}$$

### NOTE:

1. Find the difference of numerator and denominator of right part, i.e.,  $(12 - 7 = 5)$ .

2. Add the difference to the numerator of the left part i.e.,  $(0 + 5 = 5)$ .

3. Consider whole part i.e., 8 and subtract 1 as per the rule i.e.,  $(8 - 1 = 7)$

$$7 \frac{5}{12}$$

$$12 - 7 = 5 = \text{difference}$$

$$0 + 5 = 5 = \text{numerator}$$

$$8 - 1 = 7 = \text{whole}$$



## FRACTION MULTIPLICATION

$$\frac{7}{8} \times 5$$

$$= 4 \frac{3}{8}$$

### NOTE:-

1. Find the difference of numerator and denominator i.e.,  $(8 - 1 = 7)$ .

2. Multiply 1 with the multiplier, i.e.,  $1 \times 5 = 5$ .

3. Find the difference of the denominator and answer got in the second step, i.e.,  $8 - 5 = 3$  is numerator.

4. Add 1 to the whole part as per the rule, i.e.,  $0 + 1 = 1$ .

5. Multiply this with the multiplier, i.e.,  $1 \times 5 = 5$  and then subtract 1, i.e.,  $5 - 1 = 4$  is whole part.

$$4 \frac{3}{8}$$

**Sutra**      Anurupyena      proportionate

**NOTE:** Introduce cubes of numbers – speed writing.

NUMBERS	CUBE VALUES
1	1
2	8
3	37
4	64
5	125
6	216
7	343
8	512
9	729
10	1000
11	1331
12	1728
13	2197
14	2744
15	3375
16	4096

1.  $(12)^3$                       2:1

$1^3$                                    $2^3$

$$\begin{array}{cccc}
 1 & 2 & 4 & 8 \\
 & 4 & 8 & \\
 \hline
 1/ & 6/ & 2/ & 8
 \end{array}$$

1728

Write the cube of first and last digit apart

$1 \times 2/1 = 2$

$2 \times 2/1 = 4$

$4 \times 2/1 = 8$

Multiple double the middle digits. Add the numbers.

2.  $(23)^3$                       3:2

$2^3$                                    $3^3$

$$\begin{array}{cccc}
 8 & 12 & 18 & 27 \\
 & 24 & 36 & \\
 \hline
 8/ & 36/ & 54/ & 27
 \end{array}$$

12167

$^4 \quad \cancel{8} \times 3/\cancel{2} = 12$

$^6 \quad \cancel{12} \times 3/\cancel{2} = 18$

$^9 \quad \cancel{18} \times 3/\cancel{2} = 27$

3.  $(31)^3$  1:3

$$\begin{array}{r}
 3^3 \qquad \qquad 1^3 \\
 27 \quad 9 \quad 3 \quad 1 \\
 \quad \quad 18 \quad 6 \\
 \hline
 27/ \quad 27/ \quad 9/ \quad 1
 \end{array}$$

29791

4.  $(1.3)^3$

$(13)^3$  3:3

$$\begin{array}{r}
 1^3 \qquad \qquad 3^3 \\
 1 \quad 3 \quad 9 \quad 27 \\
 \quad \quad 6 \quad 18 \\
 \hline
 1/ \quad 9/ \quad 27/ \quad 27
 \end{array}$$

2197

$$\begin{array}{r}
 9 \\
 \cancel{27} \times 1/\cancel{3} = 9 \\
 \\
 3 \\
 \cancel{9} \times 1/\cancel{3} = 3 \\
 \\
 \cancel{3} \times 1/\cancel{3} = 1 \\
 \\
 \\
 \\
 \\
 1 \times 3/1 = 3 \\
 \\
 3 \times 3/1 = 9 \\
 \\
 9 \times 3/1 = 27
 \end{array}$$

## **HIGHEST COMMON FACTOR (HCF)**

1. 75, 165 (Presume as N1, N2)

Step 1 Find the difference of N1 and N2 = X.

Step 2 Find the difference of X and N1.

Step 3 Repeat the above until common factor is achieved.

Difference of 75 and 165 = 90(X)

Difference of 90(X) and 75 = 15

HCF = 15

**NOTE:** If the common factor is not achieved, then HCF = 1.  
Common factor X = multiple of N1 and N2.

## **LEAST COMMON MULTIPLIER**

1. 75, 165 (Presume as N1 and N2)

First, find HCF.

Step 1 Find the difference of N1 and N2 = X.

Step 2 Find the difference of X and N1.

Step 3 Repeat the above until common factor is achieved.

Difference of 75 and 165 = 90(X)

Difference of 90(X) and 75 = 15

$$\text{HCF} = 15 \quad (\text{X})$$

LCM

Step 1 Divide N1 by X ( $75 / 15 = 5$ ). Presume 5 as Y.

Step 2 Multiply N2 by Y ( $165 \times 5 = 825$ )

$$\text{LCM} = 825$$

### **CUBE ROOTS**

Ending of Numbers

NUMBERS	CUBE VALUES
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729
10	1000
11	1331
12	1728
13	2197
14	2744
15	3375
16	4096

1	1
2	8
3	7
4	4
5	5
6	6
7	3
8	2
9	9

$$\sqrt[3]{\underline{3375}} = 15$$

Step 1 Take 3, check its nearest value in the above chart. In this case, 3 lies in  $1^3 = \mathbf{1}$ .

Step 2 Take 375, check the ending number in the above chart. In this case, ending number of 5 is  $5 = \mathbf{5}$

$$\sqrt[3]{\underline{884736}} = 96$$

Step 1 Take 884, check its nearest value in the above chart. In this case, 884 lies in  $9^3 = \mathbf{9}$ .

Step 2 Take 736, check its nearest value in the above chart. In this case, ending number of 6 =  $\mathbf{6}$ .