

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Vedic Mathematics is a system of mathematics which was invented by Indian mathematician **Jagadguru Shri Bharathi Krishna Tirthaji Maharaj** in the period between A.D. 1911 and 1918.

It consists of 16 Sutras (methods) and 13 sub-sutras (Sub methods). Vedic Mathematics's methods are highly efficient when it comes to calculation of regular arithmetics like subtraction, multiplication, division of numbers and polynomials, squares, square roots, cubes, cube roots, solving equation, partial fractions, derivatives, conics, etc.

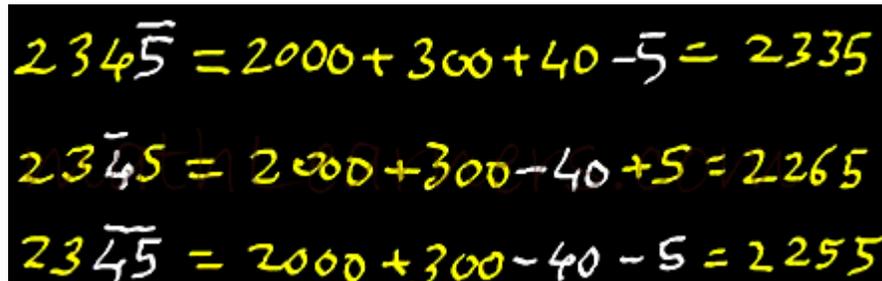
Vinculum Numbers / Vinculum Process:

Vinculum Process forms the very basic requisites for Vedic Mathematics.

Vinculum is a Sanskrit word which means a line i.e. bar over number i.e. negative digits. Vinculum numbers are numbers which have atleast 1 digit as a negative digit.

Vinculum numbers/digits are also called as Bar numbers/digits.

Eg: Vinculum number converted to normal number using Place Value concept.



Handwritten mathematical examples showing the conversion of vinculum numbers to normal numbers using place value:

$$234\bar{5} = 2000 + 300 + 40 - 5 = 2335$$
$$23\bar{4}5 = 2000 + 300 - 40 + 5 = 2265$$
$$23\bar{4}\bar{5} = 2000 + 300 - 40 - 5 = 2255$$

Another Method of **Conversion of Vinculum number to Normal number:**

Follow R -> L approach.

1. Find 1st Bar digit and takes is 10's complement.
2. a) If next digit is again Bar digit then take its 9's complement. Continue taking 9's complement till non-bar digit is obtained.
b) Decrement non-bar digit by 1.
1. Continue (1) & (2) till complete number is covered.

Conversion of Normal number to Vinculum number:

Follow R -> L approach.

1. Find 1st digit > 5 & take its 10's complement with a bar over it.
2. a) If next digit is again >= 5, take its 9's complement with a bar over it & continue this till a digit <5 is obtained.
b) Increment <5 digit by 1.
1. Continue (1) & (2) till complete number is covered.

Conversion of Vinculum numbers to Normal numbers and vice versa is very important for other concepts of Vedic Mathematics.

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Subtraction using Vinculum:

Handwritten examples of subtraction using Vinculum:

$$\begin{array}{r} 783 \\ - 348 \\ \hline 44\bar{5} \\ = 435 \end{array}$$
$$\begin{array}{r} 623 \\ - 376 \\ \hline 35\bar{3} \\ = 247 \end{array}$$
$$\begin{array}{r} 19083 \\ - 1831 \\ \hline 18852 \\ = 17252 \end{array}$$
$$\begin{array}{r} 11111 \\ - 9876 \\ \hline 1\bar{8}\bar{7}\bar{6}\bar{5} \\ = 1235 \end{array}$$

mathlearners.com

(More examples on <http://mathlearners.com/vedic-mathematics/basic-requisites/>)

Nikhilam Navatascaramam Dastah:

Popularly called as **Nikhilam** Sutra and English it means as 'All from 9 and last from 10'.

Nikhilam Sutra in Multiplication is used whenever the numbers are closer to power of 10 i.e. 10, 100, 1000,

This creates 3 groups:

1. Numbers are less than power of 10 i.e. 10, 100, 1000,
2. Numbers are more than power of 10 i.e. 10, 100, 1000,
3. Numbers are present on either side of power of 10 i.e. 10, 100, 1000,

Multiplication of numbers just* less than power of 10 (Nikhilam Method)

$$\begin{array}{r} 94 \quad -6 \\ \times 96 \quad -4 \\ \hline 90 \overline{) 24} \\ = 9024 \end{array}$$

1. Both the numbers are closer to 10 power (**base 100**)
2. 94 is 6 less than 100 & 96 is 4 less than 100.
3. $(-6) \times (-4) = 24$
4. $94 - 4$ OR $96 - 6 = 90$
5. Final Answer: 9024

$$\begin{array}{r} 88 \quad -12 \\ \times 86 \quad -14 \\ \hline 74 \overline{) 68} \\ = 7568 \end{array}$$

1. Both the numbers are closer to 10 power (**base 100**)
2. 88 is 12 less than 100 & 86 is 14 less than 100.
3. $(-12) \times (-14) = 168$ (Since base is 100, we need to have **ONLY 2 digits, so carry forward 1. Use 168**)
4. $88 - 14$ OR $86 - 12 = 74$
5. Add 1 (**carry forward**) to 74 = 75
6. Final Answer: 7568

mathlearners.com

For more tricks on Vedic Mathematics visit www.mathlearners.com

Follow us on Facebook: www.facebook.com/mathlearners

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Multiplication of numbers just* greater than power of 10
(Nikhilam Method)

$$\begin{array}{r} 103 + 3 \\ \times 108 + 8 \\ \hline 111 \overline{) 24} \\ = 11124 \end{array}$$

1. Both the numbers are closer to 10 power **(base 100)**
2. 103 is 3 more than 100 & 108 is 8 more than 100.
3. $(+3) \times (+8) = 24$
4. $103+8$ OR $108+3 = 111$
5. Final Answer: 11124

$$\begin{array}{r} 110 + 10 \\ \times 112 + 12 \\ \hline 122 \overline{) 120} \\ = 12320 \end{array}$$

1. Both the numbers are closer to 10 power **(base 100)**
2. 110 is 10 more than 100 & 112 is 12 more than 100.
3. $(+10) \times (+12) = 120$ (Since base is 100, carry forward 1. Use 120)
4. $110+12$ OR $112+10 = 122$
5. Add 1 (carry forward) to 122 = 123
6. Final Answer: 12320

mathlearners.com

Multiplication of numbers closer to* & present either side of power of 10
(Nikhilam Method)

$$\begin{array}{r} 93 - 7 \\ \times 103 + 3 \\ \hline 96 \overline{) 21} \\ = 9621 \\ = 9579 \end{array}$$

1. Both the numbers are closer to 10 power **(base 100)**
2. 93 is 7 less than 100 & 103 is 3 more than 100.
3. $(-7) \times (+3) = -21$
4. $93+3$ OR $103-7 = 96$
5. Final Answer: 9579 (Using Vinculum)

$$\begin{array}{r} 115 + 15 \\ \times 85 - 15 \\ \hline 100 \overline{) 25} \\ = 9825 \\ = 9775 \end{array}$$

1. Both the numbers are closer to 10 power **(base 100)**
2. 115 is 15 more than 100 & 85 is 15 less than 100.
3. $(+15) \times (-15) = -225$ (Since base is 100, carry forward 2. Use -225)
4. $115-15$ OR $85+15 = 100$
5. Add -2 (carry forward) to 100 = 98
6. Final Answer: 9775 (Using Vinculum)

mathlearners.com

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Urdhva Tiryakbhyam (Vertically and Crosswise):

Commonly called as Urdhva Tiryak Sutra used in multiplication and its a General method which can be applied to any types of numbers.

Multiplication of Two 2digit numbers

Process: (Left -> Right)

1. Vertical Multiplication of 1st digits of 2 numbers.
2. Crosswise Addition (Crosswise Multiplication and adding them).
3. Vertical Multiplication of last digits of 2 numbers.



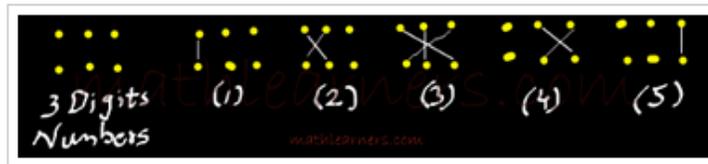
Formula :

$$(ax+b)(cx+d) = acx^2 + (ad+bc)x + bd$$

Multiplication of Two 3digit numbers

Process: (Left -> Right)

1. Vertical Multiplication of 1st digits of 2 numbers.
2. Crosswise Addition of 1st 2 digits 2 numbers.
3. Crosswise Addition of all 3 digits of both the numbers.
4. Crosswise Addition of last 2 digits 2 numbers.
5. Vertical Multiplication of last digits 2 numbers.



Formula :

$$(ax^2+bx+c)(dx^2+ex+f) = adx^4 + (ae+bd)x^3 + (af+be+cd)x^2 + (bf+ce)x + cf$$

Example:

Handwritten example of multiplying 145 by 373 using the Urdhva Tiryakbhyam method. The calculation is shown as follows:

$$\begin{array}{r} 145 \\ \times 373 \\ \hline 1 \times 3 / 1 \times 7 + 3 \times 4 / 1 \times 3 + 4 \times 7 + 5 \times 3 / 4 \times 3 + 7 \times 5 / 5 \times 3 \\ = 3 / 19 / 46 / 47 / 15 \\ = 54085 \end{array}$$

For more tricks on Vedic Mathematics visit www.mathlearners.com

Follow us on Facebook: www.facebook.com/mathlearners

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Nikhilam Sutra:

Nikhilam Sutra in Division is applied when divisor is closer to and slightly lesser than power of 10.

Examples:

$12/9$ (See Below)

1. 9 is 1(deficiency) less than 10(nearest power of 10).
2. Split Dividend in 2 parts (Quotient & Remainder) in such a way Remainder to have same digits as that of Divisor. In this case its 1.
3. Take 1 as it is down.
4. Multiply the above deficiency (1) with the 1 and put below 2 and add them column wise.
5. Thus Quotient=1 & Remainder=3.

$3483/99$ (See Below)

1. 99 is 01(deficiency) less than 100(nearest power of 10).
2. Split Dividend in 2 parts (Quotient & Remainder) in such a way Remainder to have same digits as that of Divisor. In this case its 2.
3. Take 3 as it is down.
4. Multiply the above deficiency (01) with the 3 and put them below 4 and 8(as shown), add 1st column ($4+0=4$).
5. Multiply the above deficiency (01) with the 4 now and put in next columns (as shown), add 1st column ($8+3+0=11$).
6. Repeat this process till a number comes in last column. In this example a number (4) has appeared in last column so stop here.
7. Thus Quotient=35 & Remainder=18.

The image shows three examples of the Nikhilam Sutra method for division on a blackboard background. Each example is separated by a vertical line.

- Example 1:** $12 \div 9$. The divisor 9 is 1 less than 10. The dividend 12 is split into 1 and 2. A deficiency of 1 is noted. The quotient is 1 and the remainder is 3. The calculation shows $9 \times 1 = 9$, and $12 - 9 = 3$.
- Example 2:** $243 \div 9$. The divisor 9 is 1 less than 10. The dividend 243 is split into 24 and 3. A deficiency of 1 is noted. The quotient is 27 and the remainder is 0. The calculation shows $9 \times 27 = 243$.
- Example 3:** $3483 \div 99$. The divisor 99 is 01 less than 100. The dividend 3483 is split into 34 and 83. A deficiency of 01 is noted. The quotient is 35 and the remainder is 18. The calculation shows $99 \times 35 = 3465$, and $3483 - 3465 = 18$.

Also, if deficiency has bigger digits like 6, 7, 8 and 9 then apply Vinculum and then apply Nikhilam Sutra on that.

Instead of Quotients and Remainders, division answers can be obtained in decimal format as well.

For more tricks on Vedic Mathematics visit www.mathlearners.com

Follow us on Facebook: www.facebook.com/mathlearners

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Paravartya Yogayat Sutra (Transpose and Apply):

Paravartya Sutra can be applied for division whenever divisor is closer and slightly greater than power of 10.

Process almost remains same as that of Division's Nikhilam Sutra except 1st digit of divisor is discarded and other digits are transposed.

Example:

The image shows two examples of division using the Paravartya Sutra on a blackboard background. The first example is $6534 \div 123$. The divisor 123 is written with a bar over the 2 and 3. The dividend 6534 is written as 65/34. The process involves transposing the digits of the divisor to the right of the dividend: 12 is written below 65, and 18 is written below 34. A horizontal line is drawn, and the quotient 53 is written above the line. The remainder 15 is written below the line. The final result is $Q = 53$ and $R = 15$. The second example is $13999 \div 1112$. The divisor 1112 is written with a bar over the 1, 1, and 2. The dividend 13999 is written as 13/999. The process involves transposing the digits of the divisor to the right of the dividend: 11 is written below 13, and 12 is written below 999. A horizontal line is drawn, and the quotient 12 is written above the line. The remainder 655 is written below the line. The final result is $Q = 12$ and $R = 655$. The watermark 'mathlearners.com' is visible at the bottom right of the board.

Ekadhikena Purvena Sutra:

Ekadhikena Purvena is used to find square of number which end with 5.

The image shows three examples of squaring numbers ending in 5 using the Ekadhikena Purvena Sutra on a blackboard background. The first example is 25^2 . The number 25 is written with a horizontal line above it. The digits 2 and 5 are written below the line. The product of the digits to the left of the line is $2 \times 3 = 6$, and the square of the digit to the right of the line is $5^2 = 25$. The final result is 625 . The second example is 85^2 . The number 85 is written with a horizontal line above it. The digits 8 and 5 are written below the line. The product of the digits to the left of the line is $8 \times 9 = 72$, and the square of the digit to the right of the line is $5^2 = 25$. The final result is 7225 . The third example is 195^2 . The number 195 is written with a horizontal line above it. The digits 19 and 5 are written below the line. The product of the digits to the left of the line is $19 \times 20 = 380$, and the square of the digit to the right of the line is $5^2 = 25$. The final result is 38025 . The watermark 'mathlearners.com' is visible in the background.

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Yavadunam Sutra:

Yavadunam is used to find square of a number which is closer to power of 10.

- $93^2 = (93-7)/7^2 = 86/49 = 8649$
- $89^2 = (89-11)/11^2 = 78/121 = 7921$
- $113^2 = (113+13)/13^2 = 126/169 = 12769$
- $1002^2 = (1002+2)/2^2 = 1004/004 = 1004004$

Yavadunam can be used find cube of a number but condition remains same i.e. number should be closer to power of 10.

The image shows two examples of the Yavadunam sutra for finding cubes. The first example is for 103^3 . It shows the calculation: $103^3 = 103 + (3 \times 2) \quad | \quad 9 \times 3 \quad | \quad 3^3$, which simplifies to $109 \quad | \quad 27 \quad | \quad 27$, resulting in 1092727 . The second example is for 996^3 . It shows the calculation: $996^3 = 996 + (-4 \times 2) \quad | \quad -12 \times -4 \quad | \quad (-4)^3$, which simplifies to $988 \quad | \quad 048 \quad | \quad 064$, resulting in 988048064 . Both examples include detailed text explanations of the steps and the final answers.

103³
 $= 103 + (3 \times 2) \quad | \quad 9 \times 3 \quad | \quad 3^3$
 $= 109 \quad | \quad 27 \quad | \quad 27$
 $= 1092727$

103 is 3 more than 100, Multiply the excess (3) with 2
And add the product with that number. = 109
Now Multiply the Original Excess(3) with New Excess (9) = 27
Take cube of Original Excess.
Since base 100 is used, number of digits in each group should be 2, else carry forward.
Final Answer: 1092727

996³
 $= 996 + (-4 \times 2) \quad | \quad -12 \times -4 \quad | \quad (-4)^3$
 $= 988 \quad | \quad 048 \quad | \quad 064$
 $= 988048064$

- 996 is 4 less than 1000 multiply the deficiency (-4) with 2 and add the product with that number. = 988
- Now Multiply the Original deficiency(-4) with New deficiency (-12) = +048
- Take cube of Original Excess. (-64). Convert the bar number to normal number using Vinculum.
- Since base 1000 is used, number of digits in each group should be 3, else carry forward/prefix with 0.
- Final Answer: 98,80,48,936

mathLearners.com

Square root of a perfect Square:

Examples:

Square root of 2209

1. Number ends with 9, Since it's a perfect square, square root will end with 3 or 7.
2. Need to find 2 perfect squares (In Multiplies of 10) between which 2209 exists.
Numbers are 1600(40^2) and 2500(50^2).
3. Find to whom 2209 is closer. 2209 is closer to 2500. Therefore squareroot is nearer to 50
Now from Step 2, possibilities are 43 or 47 out of which 47 is closer to 50
4. Hence squareroot = 47.

For more tricks on Vedic Mathematics visit www.mathlearners.com

Follow us on Facebook: www.facebook.com/mathlearners

Vedic Mathematics Tricks and Shortcuts

www.mathlearners.com

Square root of 7056

1. Number ends with 6, So square root ends with 4 or 6.
2. Perfect squares (In Multiplies of 10) between which 7056 exists are $6400(80^2)$ and $8100(90^2)$.
7056 is closer to 6400. Therefore squareroot is nearer to 80
3. Now from Step 2, possibilities are 84 or 86 out of which 84 is closer to 80
4. Hence squareroot = 84.

Cube Root of a Perfect Cube (Max 6 digits):

Cubes from 1- 10:

Number	Cube	Cube ends with
1	1	1
2	8	8 (Compliment of 2)
3	27	7 (Compliment of 3)
4	64	4
5	125	5
6	216	6
7	343	3 (Compliment of 7)
8	512	2 (Compliment of 8)
9	729	9
10	1000	0

Thus as seen cubes have distinct ending, there is no overlapping. Thus, if the given number is perfect cube, then the last digit will help to find the cube root.

Cube root of 1728:

1. Group the numbers from R -> L in the group of 3. So we have 1,728.
2. Last group (728) ends with 8, so cube root will end in 2.
3. 1st group is 1. Find perfect cube root ≤ 1 i.e. 1 and its cube root is 1.
4. Answer is 12.

Cube root of 300763:

1. Group the numbers from R -> L in the group of 3. So we have 300,763.
2. Last group (763) ends with 3, so cube root will end in 7.
3. 1st group is 300. Find perfect cube ≤ 300 i.e. 216 and its cube root is 6.
4. Answer is 67.