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Vedic Mathematics – A controversial Origin but a Wonderful Discovery – II

KEYWORDS

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This paper is in continuation of my first paper on Vedic Mathematics[1] published in Indian journal of applied research, vol 4, issue 1, January 2014.Vedic mathematics has made cumbersome calculations quick and interesting. These methods are claimed [2] to be rediscovered from the Vedas by Bharti Krishna Tirtha. These techniques improve efficiency and make calculations simpler. It also improves arithmetic ability. The guiding spirit of these methods is that the more you memorize, the less you have to calculate. After practicing these methods, it is claimed that a lot of time and labour is saved which is otherwise required while calculating by conventional methods. These methods are of immense use while giving competitive exams. In first paper we discussed the sutras while in this paper we have made an attempt to compare vedic methods with the conventional methods.

ALL FROM 9 AND LAST FROM 10

This method is used when we want to subtract a number from a power of 10. Suppose we want to subtract 67 from 1000. Write 67 as three digit number 067 . Now subtract each of first two digits i.e. 0 and 6 from 9 to find the digits at hundredth and tenth place respectively and last digit 7 from 10 to get digit at unit place. So the answer is 933. This one line method when applied mentally gives quick answer. The usual method of carrying 1 from extreme left to next digit on right and then subtracting, wastes our precious time and is vulnerable to commit mistakes.

9910

1ΦΦΦ

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067

933 .

MULTIPLICATION OF 'n' DIGIT NUMBER BY 9 REPEATED 'n' TIMES

For multiplication of 635 by 999 we apply vedic formula as the answer has two parts containing three digits each. Left part is one less than the number 635 and right hand part is obtained by subtracting 635 from 1000 using the method all from 9 and last from 10 as explained above. Hence 635 x 999= 634/365

(left part) (right part)

The conventional method of multiplication takes lot of time.

635 x 999 = 635 (1000 -1) Or 635

= 635000 – 635 x 999

= 634365. 5715

5715x

5715xx

634365

MULTIPLICATION BY 11

Suppose we want to multiply 236 by 11. We write the digit on extreme right as it is and then add digits from right to left in pairs, and finally the digit on extreme left as it is. So

236 x 11 = 2/2+3/3+6/6 = 2596

If addition of 2 digits in any part in this method comes to be in two digit, we keep the digit in unit place as it is and carry forward tenth place digit to the number on its left.

479 x 11 = 4/4+7/7+9/9 = 4/11/16/9 = 5269

MULTIPLICATION OF A NUMBER BY 111

The method of multiplying a number say abc by 111 is explained below.

abc x 111 = a/a+b/a+b+c/b+c/c

576 x 111 = 5/5+7/5+7+6/ 7+6/6 =

5/12/18/13/6 = 63936.

If we want to multiply a number with a multiple of 11 or 111 we follow the following method

241 x 444 = 241 x 4 x 111 = 964 x 111

And now apply the above discussed method and answer is

964 x 111 = 9/9+6/9+6+4/6+4/4
= 107004

In the conventional method 241

x 444

964

964x

964xx

107004

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URDHVA TIRYAK METHOD / VERTICALLY AND CROSS-WISE

Product of two digit numbers can be obtained with this method. Suppose we want to multiply 23 with 31. We start from right hand side and multiply two digits on extreme right i.e 1x3 to get digit on extreme right. Next we multiply cross wise and add i.e. 2x 1 and 3x3 are added to get 11. This being a two digit number , the digit at unit place is kept and the digit at tenth place is carried to the number obtained on extreme left by multiplying vertically 3 and 2.

23

X31↑

6/11/ 3 = 713.

Product of three digit numbers is similar. Suppose we want to multiply abc with def , we multiply first vertically and then cross wise as follows.

a b c

x d e f

ad/ae +db/af + dc + be /bf+ec/fc

If a number in any part is greater than 9, we keep the digit at unit place and carry the tenth place digit to the number on its left.

Example :

376

x 413

12/(3x1)+(4x7/(3x3)+(4x6)+(7x1)/(7x3)+(1x6)/6x3

= 12/31/40/27/18 = 12/31/40/28/8 =

12/31/42/8/8 = 12/35/2/8/8 = 15/5/2/8/8

= 155288

It is pertinent to point out that on first look Urdhva Tiryak method seems to be complicated and lengthy but as one practices, it becomes more simpler and less time consuming.

MULTIPLICATION OF POLYNOMIALS

The above method can be used to multiply polynomials. If we want to multiply two polynomials, first make them of same degree by adding zero times power of x which is missing. Suppose we want to multiply $2x^2 + 5x + 5$ with $5x + 9$. We write both polynomials as of same degree and write missing terms as zero multiplied with required power of x. Now we apply same method as discussed above for multiplication of 3 digit numbers.

a b c

x d e f

ad/ae +db/af + dc + be /bf+ec/fc

Here we donot carry forward any thing.

$2x^2 + 5x + 5$

X $0x^2 + 5x + 9$

x^4 /$10x^3$+$0x^3$/$18x^2$ + $25x^2$+ $0x^2$/45x + 25x /45

Hence the answer $10x^3 + 43x^2 + 70x + 45$ is obtained in one line

Conventional method

$2x^2 + 5x + 5$

X $5x + 9$

$18x^2 + 45x + 45$

$10x^3 + 25x^2 + 25x$.

$10x^3 + 43x^2 + 70x + 45$

NIKHILAM

This method is useful in multiplication of numbers close to same base. Say we want to multiply 987 and 993. Both are close to 1000, so base here is 1000. We write the number on left and its difference from base (with +ve or –ve) sign on the right as a three digit number.

987/-013

993/-007

Now multiply the numbers on right hand side and write the product below it. Next add cross wise, either 987 + (-007) or 993 + (-013) and write the answer on the left of previously written part.

987/-013

x 993/-007

980/091

If the number is greater than the base, the method is same but numbers are added cross wise. For example product of 103 and 105 is

103/+03

105/+05

108/15

Here base is 100 so the difference on the right hand side is written as a two digit number.

If one number is greater than base and other is less than base, then the number on the right hand side is negative. In such a case we solve it as follows

1015/+015

x 995/-005

1010/-075

To make right hand part positive, we carry 1 from left hand number i.e. 1010 and reduce the number by 1. 1 carried to right hand part is equal to 1000 (the base) and right hand number 075 is subtracted from it ,using method 'all from 9 and last from 10'. So

1015/+015

x 995/-005

1010/-075 = 1009/925 = 1009925

If the base is 50 , it can be considered as half of 100 or 5 times 10. Suppose we want to multiply 47 with 43 with base 50 as half of 100, as done earlier we write the number on left and its difference from 50 on right . Since 50 is taken as half of base 100 so the number on right hand side is written as a two digit number. So the product is

47/-03

x 43/-07

40/21

Since 50 is considered as half of 100, we divide number 40 on left hand side by 2 i.e. 40/2= 20. So the product is 2021.

If we consider 50 as 5 x 10 and take base as 10, the method is similar, but we should be careful that difference on right hand side is single digit number, So

47/-3

x 43/-7

40/21

Since 50 is 5x 10 (base) so we multiply number on left hand side by 5 i.e 40 x 5= 200.

47/-3

x 43/-7

200/21

Next look at the number on right hand side. It is two digit number. So we keep number at unit place and number at tenth place is carried forward to left hand number. So the answer is

47/-3

x 43/-7

202/1 = 2021.

Note that the answer is same in both the cases.

If on dividing the left hand digit we get a fraction, we solve it as follows. Suppose we want to multiply 243 with 256. Base is 250 (which is ¼ of 1000). The number on right hand side is three digit number.

243/-007

x 256/+006

249/-042

The number on left i.e. 249 is divided by 4 (as 250 = ¼ 1000).

249x ¼ =62 ¼ .

So the answer is 62 ¼ / -042.

Now ¼ on left is carried to right hand side and is equal to 250 = ¼ x 1000 = ¼ of the base. So right hand side is 250 – 042 = 208.

So 62 ¼ / -042 = 62/208 = 62208.

FINDING SQUARES OF NUMBERS

If a number has 5 at its unit place, we follow the rule **Ekadhiken Purven** (one more than the previous one) . Suppose we want to find square of 85. We multiply 8 by one more than itself i.e. 9 to get the left hand part followed by 5x 5= 25.

85^2 = 8 x 9/25 = 7225

Similarly if a three digit number with 5 at unit place is taken, we consider first two digits as the number which is to be multiplied by more than itself followed by 25. So

205^2 = 20 x 21/ 25 = 42025.

Same method is applicable if all digits are same except digits at unit place or sum of digits at unit place is 10. So

42 x 48 = 4x5/ 2x4=2016

134 x 136 = 13 x 14/ 4x6 = 18224

SQUARE OF ANY NUMBER

To evaluate square of any number we must know its **Dwandwa (duplex)**. We shall denote duplex of any Number x by D x.

Duplex of one digit number is its square, so Dx = x^2.

Duplex of two digit number xy is Dxy = 2.x.y

So D54 = 2x5x4 = 40

Duplex of three digit number xyz is Dxyz = 2.x.z + y^2

So D731 = 2x7x1 + 3^2 = 14 + 9 = 23.

D xyzt = 2x.t +2t.z.

Duplex of four digit number xyzt is Dxyz = 2.x.t + 2yz

And similarly we can find Dwandwa of any number.

Rule for finding square of a number

1) $(xy)^2$= Dx/Dxy/Dy

So 63^2= D6/D63/D3 = 36/36/9

Starting from right in each part, digit at unit place is kept and tenth place digit is carried to number on its left.

So 63^2= D6/D63/D3 = 36/36/9 = 3969.

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2) $(xyz)^2$ =Dx/Dxy/Dxyz/Dyz/Dz

So 413^2 = D4/D41/D413/D13/D3

= 4^2/2x4x1/2x4x3 + 1^2 / 2x1x3 / 3^2

= 16/8/25/6/9

= 170569

In some cases when we apply Vedic maths, it looks to be more complicated and time consuming but after practicing time and again, we find all the methods very simple and less time consuming as compared with calculating with conventional methods. In case of finding square of a number, after understanding method of finding Dwandwa, the answer comes in one line.

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