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Beauty of Vedic Speed Mathematics in Division

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Abstract:

Vedic Mathematics is the former system of Mathematics which was formulated and encapsulated in the modern form by Jagadguru Swami Bharati Krishna Tirtha Ji. During the period of 1919 – 1927 he formulated a concept of Vedic Maths by deep meditation and intuition with the help of Vedas and Scriptures. He postulated sixteen sutras (formulae) and 13 sub sutras (corollaries) of Vedic Mathematics. These sutras are easy to understand, apply and remember. With the help of these sutras one can calculate faster than conventional maths and hence these are very much helpful in competitive exams like MPSC, UPSC, GET, JEE, IBPS and many other.

Keywords: *Base, Division, Sutras, Vedas, Vedic Mathematics*

INTRODUCTION

It is observed that many students as well as adults fear Mathematics and try to avoid it due to inefficiency in carrying out long multiplication & division, finding square & square roots and cube & cube roots. Swami Bharati Krishna Tirtha Ji Maharaj, 143rd Shankaracharya of Govardhan Peeth, Puri, thought deeply on this and tried to simplify these processes and constructed 16 Sutras and 13 Sub sutras by studying ancient Indian scriptures. Swamiji wrote a book "Vedic Mathematics", the book and its magic effect of speedy calculations are very much pleasing. It increases speed of calculations as well as develop interest of students in Mathematics.

OBJECTIVES OF THE STUDY:

1. To enjoy learning Mathematics.
2. To reduce difficult problems to one-line answers.
3. To overcome Maths phobia.
4. To become strong analytical thinker.
5. To improve mental ability, sharpness, creativity and self-confidence.
6. To achieve academic excellence and success in Mathematics.

The present study focused on the magical techniques in Vedic Mathematics for arithmetic division using following sutras:

1. Nikhilam Navatahscarmam Dasatah (All from nine, last from 10)
2. Paravartya Yojayet (Transpose and apply)
3. Dhwajank (Flag digit) (Using Urdhvatiryakbhyam sutra)

The conventional form of division has four terms:

(1) $Dividend\ (E)$ (2) $Quotient\ (Q)$ (3) $Divisor\ (D)$ (4) $Remainder\ (R)$

The relation between these four terms is

$$Dividend\ (E) = Quotient\ (Q) \times Divisor\ (D) + Remainder\ (R)$$

1. Nikhilam Navatascaramam Dasatah sutra is applied when the divisor is near to the base and less than base.

Structure of division:

Divisor part Modified Divisor	**Quotient part**	**Remainder part**

Nikhilam part of divisor (modified divisor) is placed in leftmost i.e. divisor part. Then the number of digits from the right side of the dividend equal to the number of zeros in the base are placed in the part of remainder and then remaining portion of the dividend is placed in the middle part i.e. quotient part.

Here, division will be carried out by using modified divisor and instead of subtraction, addition will be used in Vedic division which is found to be easier than conventional mathematics.

Algorithm to carry out Vedic Division by Nikhilam sutra:

1. Far left digit in the quotient part is considered as the first digit of quotient. Its product with the modified divisor is added to the successive digit.
2. The result of this addition is multiplied by the modified divisor and added to next digit.
3. This process is continued up to last digit of the quotient part. The results of the addition in this part will give the quotient. In this part at each place right most digit (the unit digit) will be placed as it is and extra digit (if exists) will carry to the immediate left part.
4. If addition in the remainder part is greater than the divisor, then it will be again divided by the divisor and the quotient obtained here will be added to the original quotient (obtained in quotient part) to get the final quotient and the last remainder will be considered as the final remainder of the process.

For example: 151421 ÷ 99

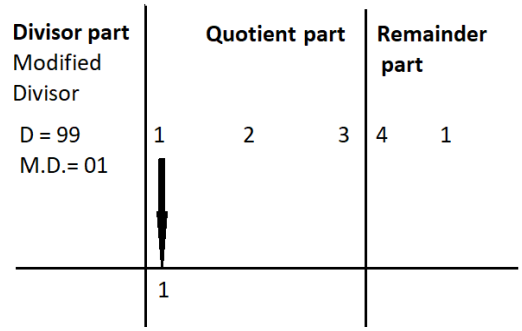
Here 99 is near to 100, so base is 100.

Deviation is calculated by applying the sutra "Nikhilam Navatascaramam Dasatah".

Deviation: (9-9) (10-9)

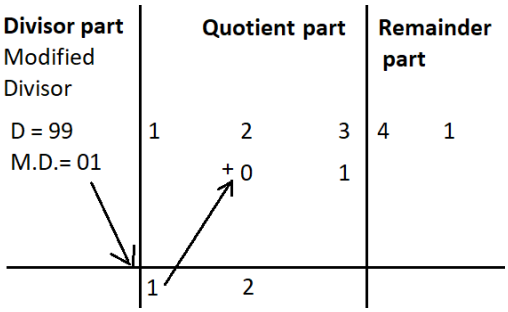
Modified Divisor (M.D.): 01

Step 1: The leftmost digit 1 will be the first digit of the quotient.



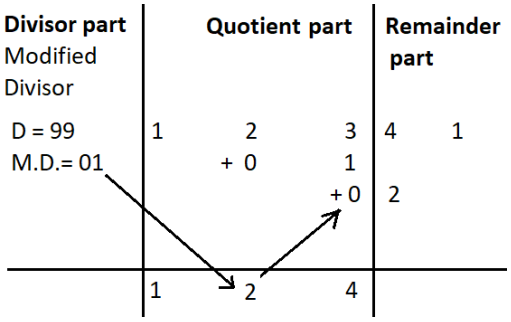
Step 2: Multiply 1st quotient digit '1' with M.D. (01) digit wise and resultant product digits are written in the next row under 2nd & 3rd column of quotient part.

Addition of 2nd column digits of quotient part gives 2nd digit of quotient.



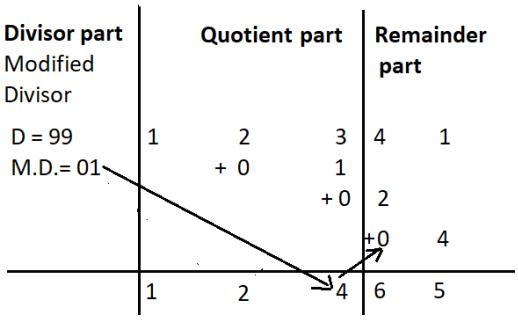
Step 3: Now multiply 2nd quotient digit '2' with M.D. digit- wise and resultant product digits are written in the next row under 3rd column in quotient part and 4th column in remainder part.

Addition of 3rd column digits of quotient part gives 3rd digit of the quotient.



Step 4: Multiply 3rd quotient digit '4' with M.D. digit-wise and resultant product digits are written in the next row under 4th and 5th column in remainder part.

Addition of 4th and 5th column digits of remainder part gives the remainder.



As we reached up to the unit place digit of dividend, the job of M.D. is over.

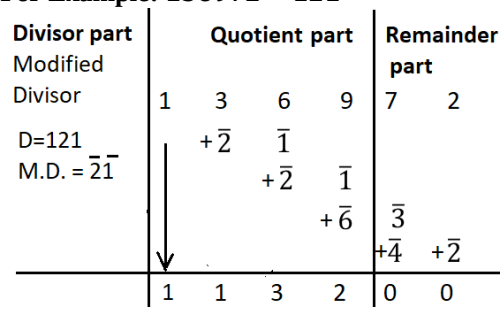
Remainder must be non-negative number less than divisor always.

Answer: Quotient = 124, Remainder = 65

2. Paravartya Yojayet sutra is applied when the divisor is near to the base and greater than base.

In this method, obtain difference between divisor and base, then give negative sign to each digit of the difference. The number thus obtained is called paravartya of the divisor. Now in spite of using Nikhilam use paravartya and follow the same procedure that we have followed in Nikhilam method.

For Example: 136972 ÷ 121

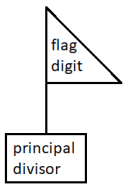


Remainder must be non-negative number less than divisor always.

Answer: Quotient = 1132, Remainder = 00

3. Dhwajank method (Flag digit): This is the universal method of division. In this method divisor is splitted into two parts. One part i.e. left part is called as the principal divisor and the remaining part on the right side is called as **"Dhwajank"(flag digit).** It is also called as flag number. Both principal divisor and dhwajank are placed in divisor part but the division is carried out by only the principal divisor.

The arrangement is like a flag. Write principal divisor in the base part and flag digit in the above part as shown in the following figure.



Algorithm to carry out Vedic division by Dhwajank (flag digit) method:

1. The number of digits from right side of the dividend, equal to the number of the digits of Dhwajank are placed in the remainder part and the remaining part of the dividend is placed into the quotient part.
2. At every stage of the division, principal divisor divides the true dividend and remainder is written before the successive digit of the dividend, which forms the gross dividend (G.D.)
3. At every stage of division, applying Urdhvatiryagbhyam sutra (vertically and crosswise) product is subtracted from gross dividend and the result of subtraction is considered as the true dividend. Now divide the true dividend by the principal divisor, we get the successive digit of the quotient as well as the remainder at that stage and the process continues by placing this remainder before the next digit.
4. At any stage if Urdhvatiryag product is greater than the gross dividend, division process can't step forward. In this case decrease previous digit of the quotient by 1 to get the proper gross dividend for subtracting the Urdhvatiryag product.

For example: $23754 \div 74$

Here we split the divisor 74 in two parts, 7 as the principal divisor and 4 as the flag digit. As there is 1 flag digit, remainder part contains 1 digit only.

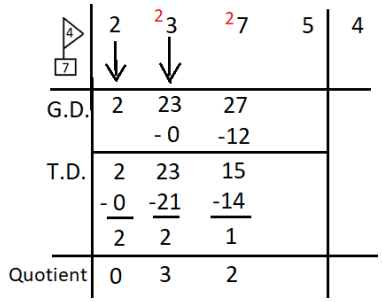
Step 1: Divide 2 by principal divisor 7, we get the quotient 0 and remainder 2.

4 / 7	2	3	7	5	4
G.D.	2				
T.D.	2				
	- 0				
	2				
Quotient	0				

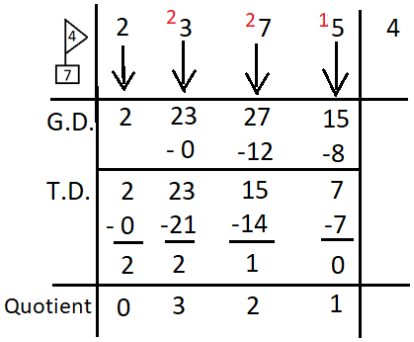
Step 2: Place remainder 2 before next dividend digit 3, we get 23 as gross dividend. Now subtract Urdhva (vertical) product of flag digit 4 and the first quotient digit 0 (i.e. $4 \times 0 = 0$), we get true dividend $23 - 0 = 23$. Now divide it by principal divisor 7, we get second digit of quotient as 3 and remainder 2.

4 / 7	2	2 3	7	5	4
G.D.	2	23			
		- 0			
T.D.	2	23			
	- 0	-21			
	2	2			
Quotient	0	3			

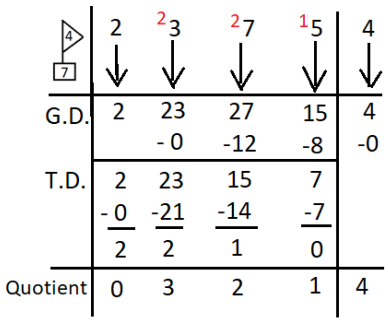
Step 3: Place the remainder 2 before next dividend digit 7, we get 27 as gross dividend. Now subtract Urdhva product of flag digit 4 and the second quotient digit 3, we get true dividend $27 - 12 = 15$. Now dividing it by principal divisor 7, we obtain third digit of quotient as 2 and remainder 1.



Step 4: By following same procedure as in step 2 and step 3, we get quotient as 1 and remainder 0.



Step 5: Finally subtract vertical multiplication of remainder 0 and flag digit from 4 (remainder part), we get the final remainder as 0 and final quotient 321.



Answer: Quotient = 321, Remainder = 0

Remainder must be non-negative number less than divisor always.

CONCLUSION

The present paper gives different techniques for arithmetic division using three Vedic sutras, which provides correct and fast solutions as compare to the method in conventional mathematics. Nikhilam and Paravartya Sutra can be applied to limited problems i.e. when divisor is near to base whereas Dhwajank method can be applied to any divisor. These methods make solving problems easier and interesting, that would be beneficial to those who are afraid of Maths.

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