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Statistics

EKADHIKEN PURVEN-BEAUTY OF VEDIC MATHS

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ABSTRACT It has been proven in many medical research that Vedic Maths keep both sides of brain fit. In cut throat competition of today's world, where the only constraint is time, the need is to train the students in such a way that they can do long calculations in a very short time. Vedic Maths does the same. Though there are many controversies about the origin of Vedic Maths Sutras, but it is not important. The only thing that is important is that these Sutras are very handy in saving precious time. In this paper we are discussing the one very important and interesting Sutras of Vedic Maths that is Ekadhiken Purven and some of its applications in various mathematical problems and their algorithms in detail.

KEYWORDS : Sutras, Ekadhiken Purven, Vulgar fractions, Recurring decimals

INTRODUCTION:

16 Sutras of Vedic Maths open a new horizon and they help in all the 8 fundamental Arithmatical operations viz. addition, subtraction, multiplication, division, square, square root, cube and cube root. Objective of the study is to develop critical and logical thinking and one-line solutions of difficult mathematical problems, so that students overcome their Maths Phobia, as according to a survey more than 50% of students who have passed primary level examination are still unable to do simple mathematical calculations.

The present study focused on 1 magical Sutra of Vedic Maths that is Ekadhiken Purven. Ekadhiken Purven method has several applications in all the mathematical problems like addition, subtraction, multiplication, division, finding some special squares, converting vulgar fractions into equivalent recurring decimals, testing divisibility and many more. Out of so many applications only little of its applications are discussed till now. In this paper we are discussing the application of Ekadhiken Purven sutra in finding special squares, some special type of multiplications and conversion of vulgar fractions of numbers ending in nine.[1]

Ekadhiken Purven:

The literal meaning of Ekadhiken Purven is "By one more than the previous one". If the number is 19,24,69,101,…;then Ekadhik Purven are 2,3,7,11…respectively. [1]

Besides Addition and subtraction, Ekadhiken Purven method is used in solving following problems:

a) Finding squares of a number that is ending in 5

Algorithm:

The answer comes into two parts.

1] The RHS part of the answer is square of 5 that is 25.

2] LHS of the answer is product of remaining digit and its Ekadhik (means by more than one).

Mathematically, for finding the square of a number (A 5), the answer is $A*(A+1)\,|5^2$, where A is any number

	LHS Part	RHS Part
$(A\ 5)^2$ →	$A*(A+1$	$5^2=25$

For example

LHS part | RHS part

$(65)^2 = 6*7 \quad |5^2$

$= 4225$

$(105)^2 = 10*11|\,5^2$

$= 11025$

But while applying this method for finding the squares of a number, the limitation is that the unit digit of the number should be 5. Also when in the number (A 5), whose square is to be found, if A is quite big,then for finding the LHS part of the answer ,Nikhilam or other methods has to be used ,as in Vedic Maths, there is no need to learn higher multiplication tables .For example :

$(125)^2 = 12*13\,|\,25$

= 15625, where 12*13 is obtained by Nikhilam or UrdhvaTiryak method.

a) Finding multiplication of two-digit numbers, when the sum of unit digits of multiplier and multiplicand is 10 and tens digits are same.

Algorithm: The answer comes into two parts:

1) The LHS part of answer is tens digit multiplied by its Ekadhik.

2) The RHS part of the answer is the product of unit digits of multiplier and multiplicand.

Mathematically, if the two - digit numbers to be multiplied are [10A+B] and [10A+ C] respectively with B+C=10, then according the Ekadhik rule LHS part of answer is A*(A+1), and RHS of answer is B*C. For example

```
  . 6 4      Multiply 6 by       For RHS Part
X   6 6      7 to get LHS        Multiply 4 by 6
 4 2 2 4

   1 0 8     Multiply 10         Multiply 8 by 2
X  1 0 2     by 11 to get        to get RHS
 1 1 0 1 6   LHS
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In both the above examples sum of unit digits are 10, while remaining numbers are same.

b) Conversion of vulgar fractions to equivalent recurring decimals:

A non - recurring decimal fraction is obtained if denominator of fraction contains 2 or 5 as factors while the denominator containing only prime number (except 2 or5) as factors gives recurring decimals. A denominator with factors of each type of prime numbers that is partly 2 and 5 and partly 3, 7, … gives mixed decimals fraction means partly recurring and partly non- recurring. A fraction which gives recurring decimals are termed as vulgar fractions.[1]

The Conversion of vulgar fractions like 1/19,1/29, …etc.to its equivalent recurring decimals involves 18,28,…steps by Conventional maths. Also the multiplication tables of 19, 29, … should be learnt by the students if they have to convert the vulgar fractions into equivalent recurring decimals. Using "Ekadhiken Purven" sutra of Vedic Maths these vulgar fractions can be converted into corresponding recurring decimals in easy steps only or by applying mental maths. Two methods of converting vulgar fractions are multiplication or backward method and division or forward method. when the last digit of denominator is 9, then equivalent recurring decimals ends in 1 if the numerator is standard numerator 1, otherwise the value of numerator should be the last digit of recurring decimal. [1]

In Ekadhiken Purven method, first operation is to make Ekadhiken Purven (mean 1 more than the one). To convert the vulgar fractions 1/19, operate with Ekadhiken Purven 1+1=2, in 1/29, operate with 2+1=3, and so on.

Algorithm of Multiplication method:

1) In Multiplication or backward method, start with the numerator as the last digit of recurring decimal and proceed leftward continuously multiplying that last digit by Ekadhiken Purven operator means universal multiplier2,3,… respectively.
2) If the product will be of two digits or more, then put the unit digit preceding the last digit and carry the rest of it over to next immediately preceding digit towards the left.
3) Continue the process until the digits starts repeating themselves.

A general rule to make it easy is that when the product is equal to difference of numerator and denominator, then half of the answer is obtained &the remaining half can be obtained by taking the complements of half of the digits from 9.

Illustration: To Convert the fraction 1/19, into equivalent recurring decimals.

Ekadhiken Purven of 9 in 19 is 1+1 = 2, So this 2 is taken as universal multiplier or operator. As the denominator ends in 9, So the last digit of recurring decimal is 1.

1	Put 1 as the right -hand most digit	0.-----------------1
2	Multiply 1 by 2 & put 2 as immediately preceding digit	0.----------------21
3	Multiply that 2 by 2 & put 4 down as next previous digit	0.--------------- 421
4	Multiply 4 by 2, and put 8 down left to 4	0.-------------8421
5	Multiply 8 by 2 & get 16, put 6 down immediately to the left of 8 with 1 as carry over	0.-----------$_{1}$68421
6	Multiply 6 by 2 and add carry over1, thus get 13, put 3 just left of 6 with 1 as carry over	0.--------$_{1}$3$_{1}$68421
7	Multiply 3 by 2 and add carry over 1, get 7 as product, put it down just to the left of 7	0.-------7$_{1}$3$_{1}$68421
8	Multiply 7 by 2, get 14 as product, write 4 just preceding to 7 with 1 as carry over	0.----$_{1}$47$_{1}$3$_{1}$68421
9	Multiply 4 by 2 & add 1 to get 9, put it down left to 4	0.---9$_{1}$47$_{1}$3$_{1}$68421
10	Multiplying 9 by 2 gives 18, since the difference between denominator & numerator that is 19-1=18 is reached, stop multiplication after step 9, rest of the digits of answer can be obtained directly by taking complement of previous digits from 9 that is 9-1,9-2,9-4,9-8,9-6,9-3,9-7,9-4,9-9, write from right to left respectively	0.□0□5□2□6□3 □1□5□7□8□9$_{1}$ □□4□7□$_{1}$3□ $_{1}$6□8□4□2□1

In division method or forward method, the operation of division proceeds from left to right. The algorithm is same as that of multiplication method with the difference that in it start writing from left to right. Steps are as follows:

1] Divide the numerator by operator or universal divisor and write the quotient first of all, taking remainder for next step.
2] Divide that remainder and quotient by universal divisor and write the quotient next to first term, thus getting the second digit Prefix the remainder to quotient, which will be the dividend for next step.
3] Divide the dividend obtained in second step by universal divisor, write quotient as next digit with remainder as prefix.
4] continue the process until terms started repeating themselves.
5] As soon as the dividend equals the difference between numerator and denominator, half of the answer is reached. Remaining half of the answer is obtained by taking the complements of all digits from 9.

Illustration: Convert 1/19 to equivalent recurring decimal.

1	Divide numerator 1 by 2, put quotient 0 as the first digit, prefix remainder 1, so that 10 will be the dividend for next step.	0.0-------------- ----
2	Divide 10 by 2, gives quotient 5 and remainder 0, write 5 as next or second digit, which also becomes the dividend for next step, since remainder is 0	0.$_{1}$05------------ ----
3	Divide 5 by 2, write quotient 2 next to 5 as third digit with remainder 1 as prefix, so that 12 becomes the dividend for the next step	0.$_{1}$05$_{1}$2---------- -----
4	Dividing 12 by 2, write down quotient 6 as fourth digit which also becomes the dividend for the next step, since remainder is zero	0.$_{1}$05$_{1}$26-------- ------
5	Divide 6 by 2 to get 3 as quotient and 0 as remainder, write 3 as the fifth digit just ucceeding to 6	0.$_{1}$05$_{1}$263------- -------
6	Divide 3 by 2 to get sixth digit as 1and prefix remainder 1 to that digit, so that 11 become the dividend for next step	0.$_{1}$05$_{1}$263$_{1}$1---- ---------
7	Dividing 11 by 2 gives quotient 5 as the seventh digit, prefix remainder 1 to 5, so that 15 become dividend for next step	0.$_{1}$05$_{1}$263$_{1}$1$_{1}$5-- ---------
8	15 divided by 2 gives quotient 7 as the eighth digit and 17 as dividend for next step	0.$_{1}$05$_{1}$263$_{1}$1$_{1}$5$_{1}$7 -------------
9	17 divided by 2 gives quotient 8 as the ninth digit and 18 as dividend for next step	0.$_{1}$05$_{1}$263$_{1}$1$_{1}$5$_{1}$7 $_{1}$8-------------
10	since the difference between denominator & numerator that is 19-1=18 is reached, stop division, rest of the digits of answer can be obtained directly by taking complement of previous digits from 9 that is 9-0,9-5,9-2,9-6,9-3,9-1,9-5,9-7,9-8	0.$_{1}$0□5□$_{1}$2□6 □3□$_{1}$1□$_{1}$5□$_{1}$7 □$_{1}$8□9□4□73 □68□4□2□1 □

CONCLUSION;

From the examples above it is clear that Ekadhiken Purven method not only simplifies the computation, but also makes the problem easier to understand. After understanding this method, one can directly convert vulgar fractions to equivalent recurring decimal in one line. The method is not limited to the above applications only. It can also help in converting vulgar fractions into equivalent repeating decimal even if the denominator not ends in nine. For example if the fraction is 1/13,1/7,1/17,…then also Ekadhiken method can be used, by converting the fraction into equivalent fraction whose denominator ends in nine and then applying Ekadhiken Purven Algorithm.

REFERENCES:

[1] Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja; Vedic Mathematics: Sixteen Simple Mathematical Formulae from The Vedas (2015)