A UNIQUE WAY OF COMPUTING THE PRODUCT OF TWO NUMBERS ENDING IN 5: AN APPLICATION OF SUB-COROLLARY ANTYAYORDASAKE’PI

Raghavendra Prasad S G
Faculty, Dept. of Information Science Engineering, R.V. College of Engineering, Bengaluru, Karnataka, INDIA

Abstract

Due to the increase in awareness created in applications of Vedic mathematics, learning mathematics has turned into a joy for students, teachers and in particular Vedic Math community. In the Thirthaji’s book, the sub corollary, *Antyayordasake’pi* is used for squaring of the numbers ending in five and also to the multiplication of two numbers whose last digits together total is 10 and whose previous part is exactly same. This paper presents a unique way of easily finding the product of two numbers (any number of digits) ending in 5. The method addresses both cases viz., having previous part exactly same and different previous parts. Also a universal method is derived to get the product of two numbers ending in 5.

Keywords: Antyayordas’ake’pi, product of two numbers ending in 5.

Introduction

In arithmetical computations, Ekadhikena purvena is used along with the sub-corollary antyayordasake’pi to compute the product of two numbers whose sum of unit place is 10 / last digits in sets of 2, 3, and so on together total to 100, 1000 etc., and the remaining digits are the same. Even while computing squares of numbers ending in 5 (a special case under the first corolloary Ekadhikena purvena) is applied to easily arrive at the solution. This paper is an attempt to compute the product of two numbers ending in five but the remaining parts of the numbers not necessarily same.

To start with applying thought process in this direction, each of these numbers 15, 25,…95 are multiplied with each of them to form a table.

*	15	25	35	45	55	65	75	85	95
15	225	375	525	675	825	975	1125	1275	1425
25	375	625	875	1125	1375	1625	1875	2125	2375
35	525	875	1225	1575	1925	2275	2625	2975	3325
45	675	1125	1575	2025	2475	2925	3375	3825	4275
55	825	1375	1925	2475	3025	3575	4125	4675	5225
65	975	1625	2275	2925	3575	4225	4875	5525	6175
75	1125	1875	2625	3375	4125	4875	5625	6375	7125
85	1275	2125	2975	3825	4675	5525	6375	7225	8075
95	1425	2375	3325	4275	5225	6175	7125	8075	9025

The diagonal in the table represents the squares numbers 15, 25,…95 i.e., squares of two digit numbers ending in 5. It is observed that when the tenth place of the two numbers are not same, the product will either end in 25 or 75. With this observation it is possible to classify the pattern of the numbers (leaving unit place 5) for which the product of given numbers is either ends in 25 or 75.

To find a method for arriving at conclusion, given two numbers can be expressed as X5 and Y5 where X and Y represent the left part of each of numbers excluding the digit 5 in unit place. Number of digits in X and Y may be 0,1,2….

Case 1: Product of X5 and Y5 which results in a number ending in 75.

15 x 25 = 375, 85 x 35 = 2975

By observation, whenever the sum X+Y is odd the result has 75 as the last part.

Case 2: Product of X5 and Y5 which results in a number ending in 25.

15 x 35 = 525, 45 x 85 = 3825

By observation, whenever the sum X + Y is even the result has 25 as the last part. Hence it is possible to arrive at a conclusion based on the sum X + Y of the given numbers.

Examples for Case 1:

$$15 \times 25 = [(1 \times 2) + \lfloor (1+2)/2 \rfloor] / 75 = (2+1)/75 = 375$$

$$35 \times 85 = [(3 \times 8) + \lfloor (3+8)/2 \rfloor] / 75 = (24+5)/75 = 2975$$

Examples for Case 2:

$$15 \times 35 = [(1 \times 3) + (1+3)/2] / 25 = (3+2)/25 = 525$$

$$45 \times 85 = [(4 \times 8) + (4+8)/2] / 25 = (32+6)/25 = 3825$$

Hence it is possible to arrive at equations for these two cases which will cover all possible cases of product of two numbers ending in 5.

Case 1: If X + Y is odd

$$X5 \times Y5 = [(X \times Y) + \lfloor (X+Y)/2 \rfloor] / 75$$

Case 2: If X + Y is even

$$X5 \times Y5 = [(X \times Y) + (X+Y)/2] / 25$$

Further, if we take trivial cases of X and Y

When X = 0, Y = 0, then the problem reduces to 5 x 5 = 25 (satisfies Case 2)

When { X=0, Y=1 } or {X = 1, Y= 0} then the problem

reduces to 5 x 15 = 75 (satisfies Case 1)

When X = 1, Y=1, then the problem reduces to 15 x 15 = 225 (satisfies Case 2)

When the number of digits in X and Y are more than 1

Examples of case 1:

235 x 345 = 81075, 45 x 3515 = 158175, 8715 x 12345 = 107586675

Examples of case 2:

15 x 2315 = 34725, 45 x 245 = 11025.

Further, if we express the numbers in the form of algebraic expressions X + 5 and Y + 5 then

$$(X + 5)(Y + 5) = XY + 5(X + Y) + 25$$

If X + Y is even then 5 (X + Y) will be multiple of hundred and hence the product ends in 25.

If X + Y is odd the 5(X + Y) will end in 50 which added with 25 results in a product ending in 75.

Conclusion

Hence it can be generalized that product of two numbers ending in 5 expressed as X5 and Y5 can be easily found using

Case 1: If X + Y is odd $X5 \times Y5 = [(X \times Y) + \lfloor (X+Y)/2 \rfloor]/75$

Case 2: If X + Y is even $X5 \times Y5 = [(X \times Y) + (X+Y)/2]/25$

which can be handy with a little practice evolves a simple technique to calculate . Future studies can be done to investigate product of two numbers of the form X2 x Y8, X3 x Y7…as a subset of problem solving using with the sub corollary antyayordasakepi.

Reference

[1] Vedic Mathematics, Jagadguru Swami Sri Bharati Krsna Tirthaji Maharaj