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Original Article

Comparative Study of Traditional and Vedic Mathematics Methods for Calculating Square of a Number

Mahesh Jivanrao Kulkarni[1]

[1]*Swami Vivekanand Vidyalaya,Chitte-Pimpalgaon.Aurangabad,Maharashtra,India*

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Abstract - *Vedic mathematics is one of the most precious and valuable gift given by Shri Bharati Krishna Tirthaji Maharaj to India. The present paper provides a comparative study of the traditional and Vedic mathematics methods for calculating square of a number. In Vedic mathematics there are many methods to calculate squares of numbers, as compared to the traditional mathematics.*

Keywords *– Calculation, Number, Square, Traditional mathematics, Vedic mathematics.*

1. Introduction

Multiplication of a number with itself is known as square of thatnumber. In traditional mathematics there are very few methods, however, in Vedic mathematics there are multiple methods for calculating square of a given number.The knowledge of the Vedas and other ancient ideas is a valuable source of knowledge. Vedic mathematics is one of most precious concept given by Indian Shankaracharya Swami Bharati Krishna Tirtha Maharaj to us. He spenteight years in the Shringeri pine forest Shringeri Moth practicing Brahma Sadhana and learning advanced vedant theory between 1911 to 1918. He wrote a book titled 'Vedic mathematics' published in 1965. It is based on 16 Sutras and 13 Upsutras. These are very easy and quick methods for mental calculations.

2. Comparision Of Traditional And Vedic Methods For Calculating Square Of A Number

2.1. Finding square of a number by traditional method

Example 1: $(98)^2$

			9	8
		×	9	8
		7	8	4
+	8	8	2	**0**
	9	6	0	4

Example 2: $(1003)^2$

				1	0	0	3
			x	1	0	0	3
				3	0	0	9
+			0	0	0	0	**0**
+		0	0	0	0	**0**	**0**
+	1	0	0	3	**0**	**0**	**0**
	1	0	0	6	0	0	9

It is evident from the above two Examples that calculating square of a number is lengthy, and tedious, when the square is calculated by traditional method.

2.2. Finding square of a number by Vedic method

Method: I – By YavdunamUpsutra

This is use when the number is close to a base or a sub-base.

The base is likely a number closer to power of 10, i.e., 10,100,1000,10000, …. The sub-base is likely a number which ismultiple of 10,100,1000, …, i.e., 20,30,400,5000, ….

$Deviation = Number - Base.$

$(Number)^2 = (Number + Deviation) : (Deviation)^2$

Here the answer is divided in two parts. The first part is(Number + Deviation), and the second part is$(\text{Deviation})^2$.In the second part number of digit is equal to zeroin base.By this formula we can find square of a number.

Example 3: $(98)^2$

Using the steps recited herein above, wecalculate the square of 98.Here 98 is close to 100. So, the base is 100.Now find Deviation.

$\text{Deviation} = \text{Number} - \text{Base}.$

$\text{So, Deviation} = 98 - 100 = -2$

$(\text{Number})^2 = (\text{Number} + \text{Deviation}) : (\text{Deviation})^2$

$(98)^2 = 98 + (-2) : (-2)^2$

$= 96 : 04$

$(98)^2 = 9604$

Example 4: $(1003)^2$

Using the steps recited herein above, we calculate the square of 1003. Here 1003 is close to 1000. So, the base is 1000. Now find Deviation.

$$\text{Deviation} = \text{Number} - \text{Base}$$

$\text{So, Deviation} = 1003 - 1000 = 3$

$(\text{Number})^2 = (\text{Number} + \text{Deviation}) : (\text{Deviation})^2$

$(1003)^2 = 1003 + (3) : (3)^2$

$= 1006 : 009$

$(1003)^2 = 1006009$

Example 5: $(304)^2$

Here 304 is not close to 100, so the sub-base =300 (3×100)

So, the first part of answer is =$3(304 + 4) = 3(308) = 924$

Second part of answer $(4)^2 = 16$

$(304)^2 = 3(304 + 4) : (4)^2$

$= 924 : 16$

$(304)^2 = 92416$

Method: II – By Ekadhikenpurven sutra

Using this formula, we can find square of number ending with 5.(Unit place digit is 5).Here the answer is divided into twoparts.

Part I) Product of digit except unit place & one more thandigit except unit place.

Part II) Square of digit at unit place.

Example 6: $(65)^2$

$(65)^2 = (6 \text{ x } 7) : (5)^2$

$= 42 : 25$

$(65)^2 = 4225$

Here part I is $6 \times 7=42$

Part II is $(5)^2=25$

Example 7: $(115)^2$

$(115)^2 = (11 \text{ x } 12) : (5)^2$

$(115)^2 = (132):(25)$
$(115)^2 = 13225$

Method: III – Square by Anurupyen(Proportionately)Upsutra

This upsutra is generally used to find square of two-digitnumber. By using this upsutra the answer is mainly divided in 3 parts.
Part I. Square of digit at ten's place.
Part II. Write the product of digits at unit place and ten's place twotimes.
Part III. Square of digit at unit place.
Lastly combine all the three, ensuring that second & third part is a single digit.

Example 8: $(32)^2$
$(32)^2 = (3)^2 : (3) \times (2) : (2)^2$
$\underline{\qquad\qquad : (3 \times 2) : \qquad}$
$9 \;:\; 12 \;:\; 4$
$(32)^2 = 1024$

Example 9: $(43)^2$
$(43)^2 = (4)^2 : (4) \times (3) : (3)^2$
$\underline{\qquad\qquad : (4 \times 3) : \qquad}$
$16 \;:\; 24 \;:\; 9$
$(43)^2 = 1849$

Method: IV – Square by Duplex:

Before use this concept, let's learn finding Duplex . In general Duplex denoted by letter 'D' .Duplex of single digit number is square of that digit.
$\mathrm{D}(x) = (x)^2 \; i.e., \mathrm{D}(3) = (3)^2 = 9$
Duplex of two-digit number is two times the product of that two digits.
$\mathrm{D}(xy) = 2 \times (x) \times (y) \; i.e., \mathrm{D}(23) = 2 \times 2 \times 3 = 12$
Duplex of three-digit number is,sum of square of middle digit & product of extreme digits.
$\mathrm{D}(xyz) = (y)^2 + 2xy \; i.e., \mathrm{D}(234) = (3)^2 + 2 \times 2 \times 4 = 25$
By the concept of Duplex , we can find square of any number easily.

Square of two-digit number.

$(xy)^2 = D(x):D(xy):D(y)$
The answer is divided into 3 parts. First part is Duplex of digit at ten's place, second part is Duplex of ten's place digit & unit place digit & third part is Duplex of digit at unit place.
Lastly combine all the three, ensuring that second & third part is a single digit.
Example 10: $(52)^2$
$(52)^2 = D(5):D(52):D(2)$
$\quad = 25:20:4$
$(52)^2 = 2704$

Example 11: $(82)^2$
$(82)^2 = D(8):D(82):D(2)$
$\quad = 64:32:4$
$(82)^2 = 6724$

Square of three-digit number

$(xyz)^2 = D(x):D(xy):D(xyz):D(yz):D(z)$
The answer is mainly divided into 5 parts . First part is Duplex of digit at hundred place, second part is Duplex of hundred place digit & ten's place digit ,third part is Duplex of digit at hundred place, ten's place & unit place ,fourth part is Duplex of ten's place digit & unit place digit and fifth part is Duplex of digit at unit place.
Lastly combine all the five , ensuring that second , third , fourth & fifth part is a single digit.
Example 12: $(243)^2$

$(243)^2 = D(2):D(24):D(243):D(43):D(3)$
$= 4:16:28:24:9$

$(243)^2 = 59049$

Example 13: $(523)^2$
$523)^2 = D(5):D(52):D(523):D(23):D(3)$
$= 25:20:34:12:9$
$(523)^2 = 273529$

3. Conclusion

Using methods of Vedic mathematics, calculating, or finding square of a number is simple. Further, Vedic mathematics provides multiple methods for calculating the square of a number, in contrast to limited methods in traditional mathematics. The methods of Vedic mathematics can be employed by any person and can easily use and enjoy. Additionally, the methods of Vedic mathematics can be learned with minimal efforts and in minimal time span, which makes these methods attractive alternatives for calculations in numerous modern competitive exams. Employing such methods recited in Vedic mathematics, mathematics can be made easy, and interesting.

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