Squaring using Anurupyena Method

This method is especially useful for squaring two digit numbers, but it can also be used for squaring three and four digit numbers.
For the purpose of demonstration, we will calculate 13^2 to illustrate the procedure. Here is how we do it:

Step 1:
First, we bifurcate the number to be squared into two parts, each containing a single digit, and make a note of the ratio between the two parts. For convenience, we can call this ratio the digit-ratio.

For instance:

- 14 has the ratio 1 : 4
- 26 has the ratio 2 : 6
- 77 has the ratio 7 : 7 or 1: 1
- 57 has the ratio 5 : 7 and so on...

In our example: 13 has digit-ratio 1 : 3

Step 2:
We write down the square of the left-most digit of the digit-ratio. This is followed by two separate numbers, each of which is formed by maintaining the digit ratio.

So, using the example, 13^2 has the digit-ratio 1 : 3. Squaring the left-most digit, 1, we obtain 1. This is followed by the next two numbers: 3 and 9. Please note that we are maintaining the 1: 3 ratio. So we write down :

1 : 3 : 9

The ratio of the first two numbers is 1 : 3 and the ratio of the second and third numbers is 3 : 9 or also 1 : 3.

Step 3:
We write down the middle number in the next line directly below itself and then ADD column-wise.

So, following through with the example, we have:

eg.(1) 13^2					
(Ratio 1 : 3)	1	:	3	:	9
		/	3	/	
	1		6		9

So, **13^2 = 169**

eg.(2) 12^2

(Ratio 1 : 2)

1	:	2	:	4
	/	2	/	
1		4		4

In eg.(3) the number 36 in the units place has two digits and so the 3 is carried over to the tens place, which after column-wise addition (12 + 12 + 7) gives 27. The 2 is then carried over to the hundreds place.

eg.(3) 26^2

(Ratio 2: 6 or 1 : 3)

4	:	12	:	36
		12		
4	/	$_2$7	/	6
6		7		6

In eg.(4) the number 81 in the units place has two digits and so the 8 is carried over to the tens place, which after column-wise addition (27 + 27 + 8) gives 62. The 6 is then carried over to the hundreds place.

eg.(4) 39^2

(Ratio 3: 9 or 1 : 3)

9	:	27	:	81
		27		
9	/	$_6$2	/	1
15		2		1

In eg.(5) we have an awkward ratio 4 :7, but no problem!

eg.(5) 47^2

(Ratio 4 : 7)

16	:	28	:	49
		28		
16	/	$_6$0	/	9
22		0		9

eg.(6) 107^2

(Ratio 10 : 7)

100	:	70	:	49
		70		
100	/	$_{14}$4	/	9
114		4		9

eg.(7) 113^2

(Ratio 11 : 3)

121	:	33	:	9
		33		
121	/	$_6$6	/	9
127		6		9

Explanation of Anurupyena Method

We are actually unknowingly following an algebraic method of squaring (a + b) taking into consideration **place value only**.

Considering **'a'** in the tens place and **'b'** in the units place, $(a + b)^2 = a^2 + 2ab + b^2$ can be written as

$[a / b]^2 = a^2 / 2ab / b^2$

By maintaining the digit-ratio, as used in the previously illustrated method, the algebraic ratio, beginning from the square of 'a' will be $a^2 : ab : b^2$. The ratios $a^2 : ab$ and $ab : b^2$ are exactly the same, that is: a : b. So, merely by adding the middle term, ab, we get:

$a^2 : ab : b^2$

ab

$a^2 : 2ab : b^2$

This is exactly the same as the square of (a + b)!

After much practice, the intermediate steps of writing down the ratio and carrying over digits can be skipped and the answer can be written down directly in one step, as shown below.

eg.(8) 43^2

(Ratio 4 : 3)

16	:	12	:	9
	/	12	/	
18		4		9

eg.(9) 74^2

(Ratio 7 : 4)

49	:	28	:	16
	/	28	/	
54		7		6

eg.(10) 88^2

(Ratio 8 : 8 or 1 : 1)

64	:	64	:	64
	/	64	/	
77		4		4

This method can be extended