Computing Squares of Consecutive Numbers in a Number Series

MEERA

This article focuses on computing squares of every consecutive number in a given number series such as 10-20, 20-30, 30-40, …within a few seconds. This is done through mental calculations by following the pattern observed among the square numbers. The methodology used here is a blend of observation and trial and error methods to formulate the final working rule.

A new approach based on the pattern

The following is the special pattern observed among the square numbers. Approximately 50 iterations were carried out to identify the pattern and to develop the working rule. Only whole numbers are considered here. The last digit of the square of any number can be easily obtained by squaring the last digit of the given number. While observing the pattern in the following table, **just omit the last digit (in black font) of every square number and observe the pattern among the numbers formed by the remaining digits (in red font).**

00	100	400	900	1600
01	121	441	961	1681
04	144	484	1024	1764
09	169	529	1089	1849
16	196	576	1156	1936
25	225	625	1225	2025
36	256	676	1296	2116
49	289	729	1369	2209
64	324	784	1444	2304
81	361	841	1521	2401

Keywords: Numbers, Squares, Consecutive, Pattern

The number to be added to get the next consecutive number follows the following pattern:

00	100	400	900	1600
+0	+2	+4	+6	+8
01	121	441	961	1681
+0	+2	+4	+6	+8
04	144	484	1024	1764
+0	+2	+4	+6	+8
09	169	529	1089	1849
+1	+3	+5	+7	+9
16	196	576	1156	1936
+1	+3	+5	+7	+9
25	225	625	1225	2025
+1	+3	+5	+7	+9
36	256	676	1296	2116
+1	+3	+5	+7	+9
49	289	729	1369	2209
+2	+4	+6	+8	+10
64	324	784	1444	2304
+2	+4	+6	+8	+10
81	361	841	1521	2401
+2	+4	+6	+8	+10

Here 1 repeats 4 times, 2 repeats 6 times, 3 repeats 4 times, 4 repeats 6 times, 5 repeats 4 times, 6 repeats 6 times and the pattern continues.

Based on this, when the series like 10-20, 20-30, 30-40….are taken, the following method is used.

Working Rule: To find squares of numbers from 20-30.

Step 1: First write the square of 20.Then write the last digit of square of every consecutive number by squaring the last digit of given number.

20^2	400
21^2	1
22^2	4
23^2	9
24^2	6
25^2	5
26^2	6
27^2	9
28^2	4
29^2	1
30^2	0

Table 1. Source: Author

Step 2: Consider the lower limit of the series which is 20; omit the last digit of 20 and multiply the remaining digit by 2, which is 2 × 2=4.

Now add 4 to 40 (40 is taken from the square of 20 by omitting the last digit). Continue adding 4 until you get the square of number ending with 3. Then add 5 until you get the square of the number ending with 7. Add 6, until you get the square of upper limit of the series. Thus, you will get all the square numbers between 400 and 900.

Number	Square	Method
20^2	400	Omit the last digit of 20, then 2 × 2 = 4
	+4	
21^2	441	
	+4	
22^2	484	
	+4	
23^2	529	After getting the square of the number ending with 3, switch to next number = (4 + 1)
	+5	
24^2	576	
	+5	
25^2	625	
	+5	
26^2	676	
	+5	
27^2	729	After getting the square of number ending with 7, switch to next number = (5 + 1)
	+6	
28^2	784	
	+6	
29^2	841	
	+6	
30^2	900	

Table 2. Source: Author

Example 2: Write all the squares of the numbers from 50-60

Number	Square	Method
50^2	2500	Omit the last digit of 50, then 5 × 2 = 10
	+10	
51^2	2601	
	+10	
52^2	2704	
	+10	
53^2	2809	After getting the square of the number ending with 3, switch to next number = (10 + 1)
	+11	
54^2	2916	
	+11	
55^2	3025	
	+11	
56^2	3136	
	+11	
57^2	3249	After getting the square of the number ending with 7, switch to next number = (11 + 1)
	+12	
58^2	3364	
	+12	
59^2	3481	
	+12	
60^2	3600	

Table 3. Source: Author

Example 3: Write all the squares of numbers from 1200 to 1210

Number	Square	Method
1200^2	1440000	
	+240	Leave the last digit of 1200, then 120 × 2 = 240
1201^2	1442401	
	+240	
1202^2	1444804	
	+240	
1203^2	1447209	After getting the square of the number ending with 3, switch to next number = (240 + 1)
	+241	
1204^2	1449616	
	+241	
1205^2	1452025	
	+241	
1206^2	1454436	
	+241	After getting the square of the number ending with 7, switch to next number = (241 + 1)
1207^2	1456849	
	+242	
1208^2	1459264	
	+242	
1209^2	1461681	
	+242	
1210^2	1464100	

Table 4. Source: Author

Conclusion

This method was taught to students in the class. Students found this method very helpful as it gives the squares of entire series without performing actual multiplication. The method is easy to remember and efficiently used for all 2-digit numbers. This new approach helps to generate the squares of an entire series in a few seconds. This method improves mental ability as well as increases the pace of calculation. To generate the squares of given series of numbers this method seems amazingly easy.

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MEERA is a lecturer with nine years of teaching experience for postgraduates, undergraduates, and pre-university courses. She has coordinated workshops and seminars for the active participation of students to enhance their subject knowledge and develop an aptitude for research. She keeps her passion for teaching alive through her YouTube channel **meeramaths** (https://youtube.com/@meeramaths2998?si=5E7dtzPAAb-ub0LX) Meera may be contacted at meeranathu@gmail.com