

Advanced Mathematics Support Programme®







Trick product – all the ones

11.....

- You all know what 11x11 is
- What about 111x111?

Can you guess what 1111x1111 is?





- 11111x1111?
- 111111x11111?

- Can you explain your patterns?
- Can you express a generalised rule?

Will the rule always hold?





Suggested approach

- Can you express 111 as powers of 10?
- Can you square your expression?
- What about 1111? 111111? What happens to the expressions that you simplify as your digits get longer?





- 111 can be written as 10²+10¹+10⁰
- Can you square this number?

Can you work out what happens when you run out of digits?





Extending

 Can you use an place value/indices method to work out what happens if you're multiplying two different numbers with 1s as all the digits, for example 111x11 or 11,111x111

• Are there discernible patterns if the repeated digit is not 1, for example 222² or 3,333²? If so, what are they? If not, why not?





ANSWERS.....





11.....

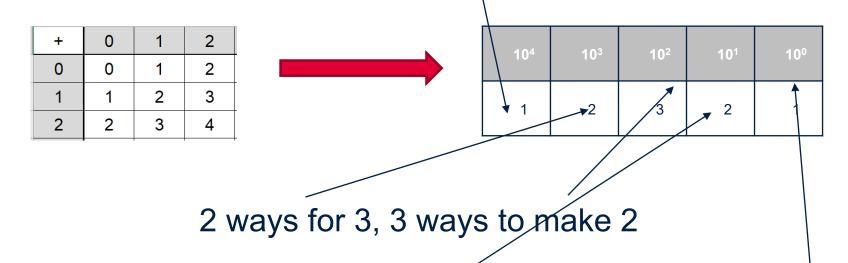
Sum	Answer
11 ²	121
111 ²	12,321
1,111 ²	1,234,321
11,1112	123,454,321
111,1112	12,345,654,321
1,111,111 ²	1,234,567,654,321
11,111,111 ²	123,456,787,654,321
111,111,111 ²	12,345,678,987,654,321





The addition square below is for the powers $(10^2+10^1+10^0)^2$.

there is 1 way to make an exponent of 4



2 ways to make 1, 1 way to make 0





+	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	6
2	2	3	4	5	6	7
3	3	4	5	6	7	8
4	4	5	6	7	8	9
5	5	6	7	8	9	10

111,111x111,111 = 12,345,654,321

(1 number with exponent 0, 2 with exponent 1, 3 with exponent 2 so 3×10^2 for example).





+	0	1	2	3	4	5	6
0	0	1	2	3	4	5	6
1	1	2	3	4	5	6	7
2	2	3	4	5	6	7	8
3	3	4	5	6	7	8	9
4	4	5	6	7	8	9	10
5	5	6	7	8	9	10	11
6	6	7	8	9	10	11	12





+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	C
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	00	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	œ	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	0	10	11	12	13	14	15	16	17	18

This shows that once you get to 1,111,111,111² you have 10 ways of generating a 9 exponent so the pattern breaks down...





About the AMSP

- A government-funded initiative, managed by <u>MEI</u>, providing national support for teachers and students in all state-funded schools and colleges in England.
- It aims to increase participation in AS/A level
 Mathematics and Further Mathematics, and Core
 Maths, and improve the teaching of these qualifications.
- Additional support is given to those in priority areas to boost social mobility so that, whatever their gender, background or location, students can choose their best maths pathway post-16, and have access to high quality maths teaching.





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