



# Advanced Mathematics Support Programme®

Managed by

**MEI** Mathematics®  
Education  
Innovation

# Trick product – all the ones

11.....

- You all know what  $11 \times 11$  is
- What about  $111 \times 111$ ?
  
- Can you guess what  $1111 \times 1111$  is?

- $1111 \times 1111$ ?
- $11111 \times 11111$ ?
  
- 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?

# Expressions to simplify

- 111 can be written as  $10^2+10^1+10^0$
- 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  $111 \times 11$  or  $11,111 \times 111$
- Are there discernible patterns if the repeated digit is not 1, for example  $222^2$  or  $3,333^2$ ? 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
$11,111^2$	123,454,321
$111,111^2$	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



# Expressions to simplify

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

+	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4



there is 1 way  
to make an  
exponent of 4

	$10^4$	$10^3$	$10^2$	$10^1$	$10^0$
	1	2	3	2	1

2 ways for 3, 3 ways to make 2

2 ways to make 1, 1 way to make 0

# Expressions to simplify

+	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

$$111,111 \times 111,111 = 12,345,654,321$$

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

# Expressions to simplify

+	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

# Expressions to simplify

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

This shows that once you get to  $1,111,111,111^2$  you have 10 ways of generating a 9 exponent so the pattern breaks down...

# About the AMSP

- A government-funded initiative, managed by MEI, 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.

# Contact the AMSP



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