

Generalising Numbers Patterns

Seven Series-ous Secrets

AC

EA

AA

AM

AP

We are investigating series (adding number sequences)
 We are practising generalisation of number patterns
 We are developing problem solving thinking skills

You and your buddy must find seven keys by solving these puzzles. There is one secret number in each exercise which is placed somewhere in the last puzzle (Exercise 8) to gain the master code.

Exercise 1 – This Lock Counts

1. What is the sum of the first 9 counting numbers?

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9$$

My answer is

Explain how you got your answer.

	1		2	5	3		4	
5								7
2			9		6			1
	8	5				1	7	
				9				
	2	7				6	8	
1			7		8			2
6								3
	9		4	3	1		5	

2. Now think of another way to add $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9$

Explain your new way.

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answers are

4. What do all the numbers add up to on a completed 9x9 Sudoku?

My answer

5. If the Sudoku size was 99x99 using the first 99 counting numbers, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using counting numbers and it was completed what would all the numbers add up to?

Exercise 2 – The Second Lock is an Odd One

Instead of using counting numbers to use as the symbols on the Sudoku puzzle we will use the first 9 odd numbers 1, 3, 5, 7, 9, 11, 13, 15 and 17.

1. What is the sum of the first 9 odd numbers?

$$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17$$

My answer

And
How I did it.

	1		3	9	5		7	
9								13
3			17		11			1
	15	9				1	13	
				17				
	3	13				11	15	
1			13		15			3
11								5
	17		7	5	1		9	

□ 2. Think of a different way to find the sum of a row in this puzzle.

My new way is

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answers

4. What do the numbers add up to on a completed 9x9 Sudoku using odd numbers?

My answer is

5. If the Sudoku size was 99x99 using the first 99 odd numbers, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using odd numbers and it was completed what would all the numbers add up to?

My answer

Exercise 3 – The Third Lock is Even Better

Instead of using odd numbers to use as the symbols on the Sudoku puzzle we will use the first 9 even numbers 2, 4, 6, 8, 10, 12, 14, 16 and 18.

1. What is the sum of the first 9 even numbers?

$$2 + 4 + 6 + 8 + 10 + 12 + 14 + 16 + 18$$

My answer

And
How I did it.

2. Think of a different way to find the sum of a column in this puzzle.

My new way is

	2		4	10	6		8	
10								14
4			18		12			2
	16	10				2	14	
				18				
	4	14				12	16	
2			14		16			4
12								6
	18		8	6	2		10	

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answers

4. What do the numbers add up to on a completed 9x9 Sudoku using even numbers?

My answer is

5. If the Sudoku size was 99x99 using the first 99 even numbers, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using even numbers and it was completed what would all the numbers add up to?

My answer

Exercise 4 – The Fourth Lock Triples

Instead of using even numbers to use as the symbols on the Sudoku puzzle we will use the first 9 multiples of three; 3, 6, 9, 12, 15, 18, 21, 24, 27 and 30.

1. What is the sum of the first 9 multiples of three?

$$3 + 6 + 9 + 12 + 15 + 21 + 24 + 27 + 30$$

My answer

And

How I did it.

2. Think of a different way to find the sum of a 3x3 block in this puzzle.

My new way is

	3		6	15	9		12	
15								21
6			27		18			3
	24	15				3	21	
				27				
	6	21				18	24	
3			21		24			6
18								9
	27		12	9	3		15	

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answers

4. What do the numbers add up to on a completed 9x9 Sudoku using multiples of 3?

My answer is

5. If the Sudoku size was 99x99 using the first 99 multiples of three, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using the multiples of three and it was completed what would all the numbers add up to?

My answer

Exercise 5 – The Fifth Lock is Powerful

Instead of using triples of numbers to use as the symbols on the Sudoku puzzle we will use the first 9 powers of two; 2, 4, 8, 16, 32, 64, 128, 256 and 512.

1. What is the sum of the first 9 powers of two?

$$2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 + 512$$

My answer

And

How I did it.

2. Think of a different way to find the sum of a row in this puzzle.

My new way is

	2		4	32	8		16	
32								128
4			512		64			2
	256	32					2	128
				512				
	4	128					64	256
2			128		256			4
64								8
	512		16	8	2		32	

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answer

4. What do the numbers add up to on a completed 9x9 Sudoku using powers of two?

My answer is

5. If the Sudoku size was 16x16 using the first 16 powers of two, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using the powers of two and it was completed what would all the numbers add up to?

My answer

Exercise 6 – The Sixth Lock is “Nine”-sense

Instead of using powers of two to use as the symbols on the Sudoku puzzle we will use the first 9 multiples of nine; 9, 18, 27, 36, 45, 54, 63, 72 and 81.

1. What is the sum of the first 9 multiples of 9?

$$9 + 18 + 27 + 36 + 45 + 54 + 63 + 72 + 81$$

My answer

And
How I did it.

2. Think of a different way to find the sum of a row in this puzzle.

My new way is

	9		18	45	27		36	
45								63
18			81		54			9
	72	45				9	63	
				81				
	18	63				54	72	
9			63		72			18
54								9
	81		36	27	9		45	

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answer

4. What do the numbers add up to on a completed 9x9 Sudoku using multiples of 9?

My answer is

5. If the Sudoku size was 99x99 using the first 99 multiples of nine, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using the multiples of nine and it was completed what would all the numbers add up to?

My answer

Exercise 7 – The Seventh Lock is Square

Instead of using triples of numbers to use as the symbols on the Sudoku puzzle we will use the first 9 square numbers; 1, 4, 9, 16, 25, 36, 49, 64 and 81

1. What is the sum of the first 9 square numbers?

$$1 + 4 + 9 + 16 + 25 + 36 + 49 + 64 + 81$$

My answer

And
How I did it.

2. Think of a different way to find the sum of a row in this puzzle.

My new way is

	1		4	25	9		16	
25								49
4			81		36			1
	64	25				1	49	
				81				
	4	49				36	64	
1			49		64			4
36								9
	81		16	9	1		25	

3. What does each row add up to? What does each column add up to? What does each square 3x3 block add up to?

My answer

4. What do the numbers add up to on a completed 9x9 Sudoku using odd numbers?

My answer is

5. If the Sudoku size was 20x20 using the first 20 square numbers, what would the numbers add up to in the completed puzzle?

My answer

6. If the Sudoku puzzle was $n \times n$ in size using the square numbers and it was completed what would all the numbers add up to?

My answer (Hint...look up square numbers in Wikipedia)

Exercise 8 – The Final Door

One of the answers from each of the exercises will fit across into the grid below. Some of the numbers have been filled in to help you select the numbers. (The answer in the last row comes from Exercise 4).

Complete the grid by choosing the remaining numbers and then add them all up to find the master code.

Each box holds a digit like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

				4	0	
					4	
					1	
			9			
				2		
						9
					5	

Multiply the secret number by 0.000 000 659 487 448 297 720 to reveal the magic number "phi" in the Da Vinci Code.

CHECK>>>Another way to calculate "phi" is $(1 + \sqrt{5})/2$

"The Code Book" written by Simon Singh is all about codes and cyphers. This code depended upon your ability to solve mathematics problems. Read Simon's book to find out about how to code secret messages. Cyphers are very important to ensure information only gets to who it is meant.

Answers

Exercise 1

1. 45, method various, probably by adding
2. Another way could be to use tidy numbers or the $n(n+1)/2$ formula or similar.
3. **45**
4. $45 \times 9 = 405$
5. $(99 \times 100)/2 \times 99 = 490050$
6. $n \times n(n+1)/2 = n^2(n+1)/2$

Exercise 2

1. 81, added, various solution methods possible
2. 9 squared = 9^2
3. 81
4. $81 \times 9 = 729$
5. $99 \times 99 \times 99 = \mathbf{970299}$
6. n cubed = n^3

Exercise 3

1. 90 or 2×45 from Exercise 1.1 or $81 + 9$ from Exercise 2.1 Maths is connected! Method various.
2. $2 \times$ Question 1 from counting numbers or from odd numbers
3. 90
4. $90 \times 9 = \mathbf{810}$
5. $99 \times 100 \times 99 = 98100$
6. $n^2(n+1)$

Exercise 4

1. $135 = 3 \times$ Exercise 1.1, various methods.
2. Added is another way.
3. 135
4. $135 \times 9 = 1215$
5. $3 \times 99 \times 100 \times 99/2 = \mathbf{1470150}$
6. $3n^2(n+1)/2$

Exercise 5

1. 1022, probably added
2. 1024 -2, or next term take 2.
3. 1022
4. $1022 \times 9 = \mathbf{9198}$
5. $(2^{17} - 2) \times 16 = 2097120$
6. $(2^n - 2)n$

Exercise 6

1. $9 \times 45 = \mathbf{405}$, various, could be $9 \times$ Exercise 1.1 or added.
2. Added
3. 405
4. $405 \times 9 = 3645$
5. $99 \times 45 \times 99 = 441045$
6. $9n(n+1)n/2 = 9n^2(n+1)/2$

Exercise 7

1. 285, added, various
2. using the formula $n(n+1)(2n+1)/6$ This is quite hard to develop and almost impossible to guess so looking up the answer on Wikipedia is suggested.

3. 285

4. $285 \times 9 = \mathbf{2565}$

5. $2870 \times 20 = 57400$. Sum of first 20 square numbers is 2870.

6. $n^2(n+1)(2n+1)/6$

Exercise 8

Numbers top to bottom

405, Ex 6

45, Ex 1

810, Ex 3

9198, Ex 5

02565, Ex 7

970299, Ex 2

1470150, Ex 4

Total is Master Code = 02 453 472 which when we multiply by the suggested factor reveals the famous number phi or 1.618...