

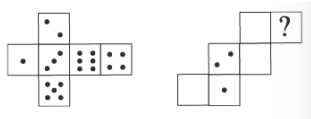
FSJM – SEMI-FINAL- 18 MARCH 2022

Information and results at <http://www.fsjm.ch/>

START for ALL PARTICIPANTS

1. Lily's dice (coefficient 1)

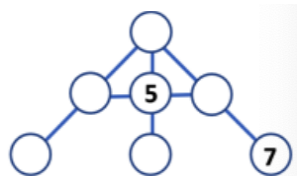
Lily has drawn a shape to make into a die by folding. She would like to build a second identical die with the shape on the right.



How many dots should she draw in the box marked with a question mark?

2. Seven Numbers (coefficient 2)

In this diagram, the sum of any three aligned numbers must equal 10.



Place the numbers

① ② ③ ④ and ⑥.

3. Just Five Letters (coefficient 3)

Complete all the boxes of the following grid using in each row, and in each column, the letters L, A, P, I, N.

		P	I	N
	I		P	A
I		N		L
P	L		N	
A		I		P

Every letter must appear exactly once in each row, and in each column.

4. Sharing String (coefficient 4)

Three children share 40 cm of string for a craft project.

Bob takes 4 cm more than Alex.

Carla takes 5 cm more than Bob.

Give the length of Bob's string in cm.

5. Stickers (coefficient 5)

Alex, Bob and Carla share these nine stickers: everyone takes three.



Alex: I have all three shapes and my triangle is black.

Bob: I have all three colours.

Carla: I have no triangle and no grey sticker.

Each has a square sticker.

What are the numbers of Carla's stickers?

END for CE PARTICIPANTS

6. Grid Division (coefficient 6)

Divide this grid into four parts so that the sum of the numbers in each part is 23.

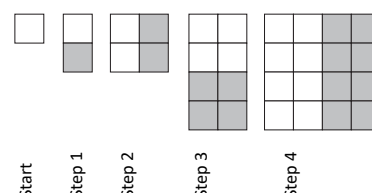
3	8	5	6
10	1	11	2
2	9	7	5
4	7	9	3

7. Lucas' Mosaic (coefficient 7)

Lucas has made a mosaic, step by step, as shown in the figure.

At each step:

- he doubles the number of tiles;
- new tiles are added alternately below, then to the right at the next step.



Matthew tells him that the sheet on which he wants to stick his mosaic can contain a maximum of 40 tiles in width and 70 tiles in length.

How many tiles does he need to create the largest mosaic possible?

8. Mirror Numbers (coefficient 8)

Max types on his calculator, a 4-digit number:

Malia, seated opposite, can read the same number.

Counting the example, how many four-digit numbers between 1000 and 2023 can Max type for Malia to read the same number?

On Max's calculator, the numbers are written as follows.



END for CM PARTICIPANTS

Problems 9 to 18: beware! For a problem to be completely solved, you must give both the number of solutions, and give the solution if there is only one, or give any two correct solutions if there are more than one. For all problems that may have more than one solution, there is space for two answers on the answer sheet (but there may still be just one solution).

9. Seven Tokens (coefficient 9)

Matthew has found these seven tokens in a game of his grandfather's.

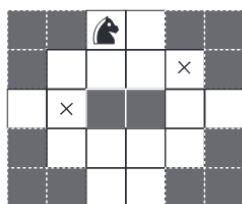
② ③ ⑤ ⑦ ⑪ ⑬ ⑰

He divides them into two groups and then calculates the product of the numbers of the tokens of each group, and realizes that the difference between the two products (i.e. the larger minus the smaller) has the smallest possible value.

What is the sum of the two products he has calculated?

10. Knight Stand (coefficient 10)

A chess knight is on the grid of the figure where only the white squares are accessible (but one can jump over a black square).



Remember that a chess knight moves across the diagonal of a rectangle of two squares by three, in any direction. The two squares marked with a cross are the only ones that the knight can reach during a first jump.

If he must never stand more than once on the same square, how many white squares can he visit at most, including his starting square?

11. Insertions (coefficient 11)

If we insert 22 between the two digits of the number 11, we obtain 1221 which is a multiple of the number 11.

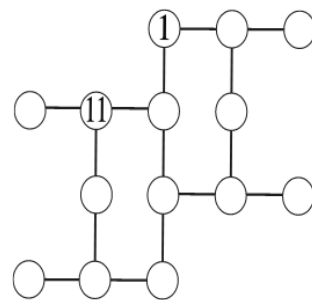
Similarly, by inserting 23 between the digits of a certain two-digit number, we obtain a multiple of this number.

What is this two-digit number?

END for C1 PARTICIPANTS

12. From 1 to 14 (coefficient 12)

Place the numbers from 2 to 14 (except 11 which is already written) in the empty boxes of this diagram.



The sum of the three or four numbers on the same segment is always equal to 25.

13. Chain of the Year (coefficient 13)



In this chain of numbers, all the numbers are multiples of 2023. When passing from one number to the next according to an arrow, the last digit of the starting number is equal to the first digit of the ending number (this digit cannot be a 0). In this example, the sum of the three numbers in the string equals 378301.

What, at minimum, is the sum of the numbers of a chain of multiples of 2023 containing at least two distinct numbers and constructed according to the same principle?

14. Mirror-culous Multiplication

(coefficient 14)

$$ABCD \times 23 = 32 \times DCBA$$

In this equation, the numbers ABCD and DCBA are written with four digits, all different, the same digit being always replaced by the same letter.

What is the number ABCD?

END for C2 PARTICIPANTS

15. Matthew's Sequence (coef. 15)

Matthew writes a sequence of numbers starting from the negative number

- 2023 and adding 4 from one number to the next:

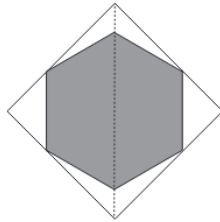
- 2023, - 2019, - 2015, - 2011, ...

When he stops, the sum of all the numbers he has written is equal to 1013.

How many numbers did he write?

16. Coat of Arms (coefficient 16)

This coat of arms consists of a regular grey hexagon inscribed in a white square.



Four vertices of the hexagon are placed on the sides of the square, and an axis of symmetry of the hexagon coincides with a diagonal of the square.

The area remaining in white represents what percentage of the total area of the square?

If the following irrationals are needed to calculate a numerical value, take $\sqrt{2}$ as 1.414, $\sqrt{3}$ as 1.732. Round the answer to the nearest tenth of a percent.

END for L1, GP PARTICIPANTS

17. Al Chemist's Calculation (coef. 17)

Albert Chemist launches into a long calculation.

$$\sqrt{23 \times 44484 + \sqrt{23 \times 44484 + \sqrt{23 \times 44484 + \dots}}}$$

This calculation includes an infinity of nested radicals, the number 23×44484 being repeated indefinitely.

What is the result of Albert's calculation?

If necessary, round the result to the nearest whole number.

18. Archie's Halls (coefficient 18)

Archie Tekte builds exhibition halls all over the world in the shape of rectangular parallelepipeds and of different sizes.

Passionate about numerology, he imposes the following constraints on himself:

- one of the dimensions of the hall must be 15 metres;

- the other two dimensions are whole numbers of metres;

- The length of the longest diagonal of the hall, expressed in metres, must be equal to the square root of the volume of the hall expressed in cubic metres.

What is the volume of Archie's hall if this volume does not exceed 10,000 m³?

END for L2, HC PARTICIPANTS