FSJM – FINAL- 25 MAY 2024

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

START for ALL PARTICIPANTS

1. Matilda's Tokens (coefficient 1)

These five tokens can be seen as 6s or as 9s. Matilda has underlined the numbers of the two tokens on the left so that the first is read as a 9 and the second as a 6. She will underline the numbers of the other three and she can then divide the five tokens into two piles of the same total.

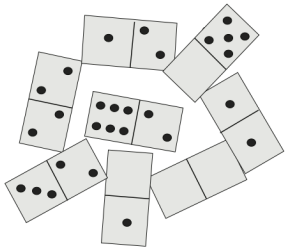
What will be the value of this total?

2. Dominoes (coefficient 2)

Dominique wants to place some dominoes between the two dominoes (2;0) and (2;4)

She must respect the rule of the game of dominoes: that two squares that touch each other must contain the same number of spots.

Of the eight dominoes shown below, how many can she use, at most?



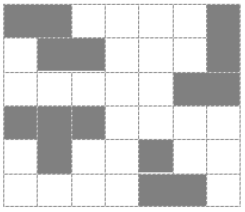
3. Mathemon Cards (coefficient 3)

Matthew to Matilda: "I have 28 Mathemon cards more than you".

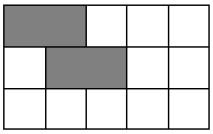
Matilda: "Yes, but you owe me 19. Give them back to me!"

When Matthew has returned 19 cards to Matilda, how many more will she have than he has?

4. Puzzle (coefficient 4)

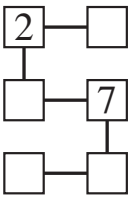


With the 4 pieces shown in the figure, we would like to fill a rectangle which must not have any empty squares. The pieces should not overlap, but they can be turned and/or flipped over.



A first piece is already placed. In how many different ways can you complete the rectangle with the other three pieces?

5. A Big S (coefficient 5)

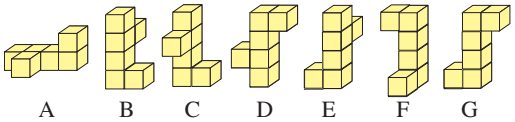


Fill each square of this figure with a number chosen from the integers 1 to 9 in such a way that:

- the six numbers are all different;
- the sum of the six numbers is 24;
- two consecutive numbers are never placed in boxes directly connected to each other;
- the five sums of the two numbers in boxes directly connected to each other are all different.

END for CE PARTICIPANTS

6. Multiplication (coefficient 6)

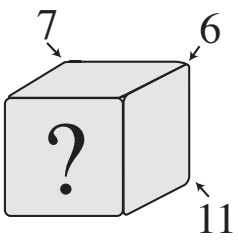


These drawings represent assemblies of six cubes Matthew has built. The same assembly is represented several times.

Write, in alphabetical order, the letters of all the drawings corresponding to this assembly.

7. Table Tennis (coefficient 7)
Seven people, A, B, C, D, E, F and G play doubles table tennis: in each game, there is a pair of two people playing against a pair of two other people.
The winning pair stays in the game and plays the next game against another pair. A person who has lost a game does not play in the game immediately afterwards.
If the pair of people A and B is very strong and always wins, how many games must they play at least to have won against all possible pairs of the other five people?

8. The Old Die (coefficient 8)
A sailor found an old die in his fishing net. The seawater has completely destroyed the numbers originally marked on its faces.



There are only a few marks left near three vertices of this die: 6, 7 and 11. Each mark gives the sum of the numbers of the three faces which meet at this vertex.
What was the number corresponding to the side marked with a question mark?

Note: the faces of the die originally bore the numbers 1 to 6.

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. Circle of Liars (coefficient 9)
Fifteen people standing in a circle say simultaneously: "One and only one of my two neighbours is lying."
How many people lied?

10. Notable Rectangle (coefficient 10)
Matilda has drawn a non-square rectangle, whose sides measure whole numbers of millimetres, on an A4 page (which measures 210 mm by 297 mm).
She adds the number of mm^2 which corresponds to the area of her rectangle to the two numbers which correspond to the length and width expressed in mm. The result is equal to 2024.
What is the perimeter of Matilda's rectangle, expressed in mm?

11. Tiling (coefficient 11)
Noel would like to lay tiles in a room that measures 4 m wide. He has tiles of three different lengths: 50 cm, 70 cm and 80 cm: all of them are 50 cm wide and he doesn't want to cut any.
He lays a first row with eight square tiles measuring 50 cm by 50 cm.
How many possibilities does he have for laying the second row knowing that in this 50 cm wide row, with the exception of the border of the room, there must be no joints in line with a joint in the first row?
Count all the solutions, even those obtained by symmetry.

END for C1 PARTICIPANTS

12. Hello, Hello, Hello! (coefficient 12)
At every session in this mathematical games club, when they arrive, everyone says "Hello!" to each of the other members of the club.
This week, there is at least one absentee. By counting the number of "Hello!"s, the facilitator finds 24 fewer than when the club is full.
How many members does the club have when it is full?
Note: When two club members say hello to each other, there are two "Hello!"s

13. All Your Eggs in One Basket
(coefficient 13)

The farmer sold 100 eggs in total, from chickens and ducks. His assistant Matt the Matick told him that he had noticed that the two categories of eggs brought in exactly the same amount of money, but added that if chicken eggs had been sold at the price of duck eggs, the sale of chicken eggs would have brought in 45 francs, while if duck eggs had been sold at the price of chicken eggs, the sale of duck eggs would have only brought in 20 francs.

What was the price of a duck egg, in cents?

14. Clumsy Sommelier (coefficient 14)

A sommelier prepares a champagne fountain. He places 25 flutes in a square, then places 16 flutes in a square on top, then 9, then 4, then 1 to obtain a 5-story pyramid as in the drawing.

He then pours champagne into the top flute until all are full. When one flute overflows, the excess flows evenly into the four flutes below.

But for the flutes at the very bottom that overflow, the excess is wasted.

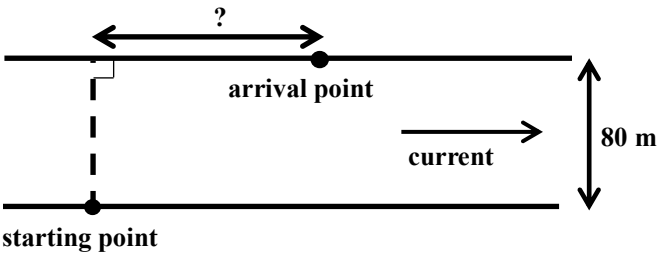
How much champagne will have been wasted by the time all the flutes are filled?

Give the answer in number of flutes in the form of a whole number or an irreducible fraction?

END for C2 PARTICIPANTS

15. Open Water Swimming (coef. 15)

Sal Mone wants to swim across a river 80 m wide.

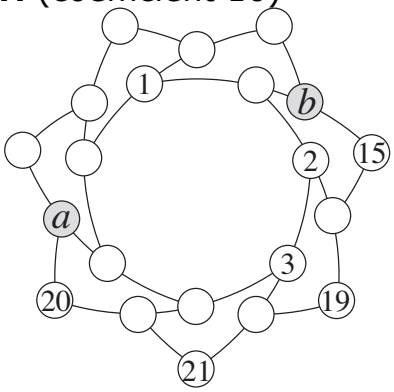


She swims at 4 km/h, but the current of the river flows at 8.5 km/h. She knows that she will not be able to reach the shore exactly opposite her starting point with such a current, but would like to get as close to that point as possible.

At what minimum distance from that point could she arrive?

Give the answer in m rounded to the nearest hundredth. Use √2 ≈ 1.414 and √17 ≈ 4.123 if you need to calculate with these values.

16. Swirl (coefficient 16)



Place the integers from 1 to 21 (except 1, 2, 3, 15, 19, 20 and 21 which are already placed) in the empty boxes of this diagram such that:

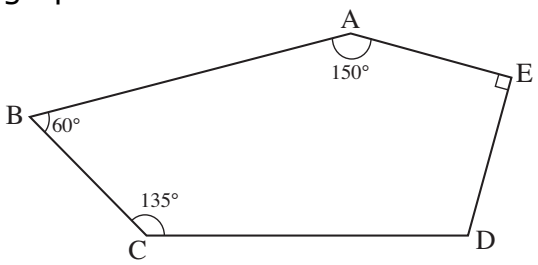
• the sum of the five numbers located around the perimeter of each curvilinear triangle equals 48;

• the sum of the seven numbers located around the perimeter of the central curvilinear heptagon equals 28.

Which numbers will go in boxes a and b?

END for L1, GP PARTICIPANTS

17. Paving Stone (coefficient 17)
Here is the diagram of one of the types of pentagonal paving stones that can pave a design plan.



If BC = AE = 1 dm and AB = 2 dm, what is the area of the paving stone?
Give the answer in cm^2, rounded to the nearest cm^2. Use $\sqrt{2} \approx 1.414$ and $\sqrt{3} \approx 1.732$ if you need to calculate with these values.

18. Matthew's Numbers (coef. 18)
On his calculator, Mathias adds the natural whole numbers in order:

$$0 + 1 + 2 + 3 + 4 \ldots$$

Before typing each number starting from the second, the calculator displays a provisional result:

0, 1, 3, 6, 10, 15, ...

Matthew notes all the provisional results which can be split into two numbers such that the first is twice the second, such as 21, 105, 2211, 9045, ...
Matthew then chooses a six-digit number from those he has noted.
What is this number?
Note: The split cannot be made just before a digit 0.

END for L2, HC PARTICIPANTS

The Swiss Federation of Mathematical Games warmly thanks its sponsors for their help in organizing this event.

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