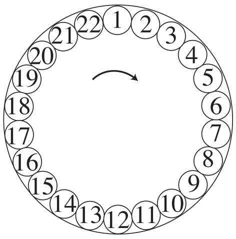
FSJM – FINAL- 14 MAY 2022

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

START for ALL PARTICIPANTS

1. 22 Marbles (coefficient 1)



Matthew has stored 22 marbles in a round box as shown in the figure. He removes marble n°1, then marble n°4, then marble n°7, then he continues by removing each third marble of those remaining, moving round the box as shown by the arrow. He stops when there are two marbles left in the box and adds up their numbers.

What total does he find?

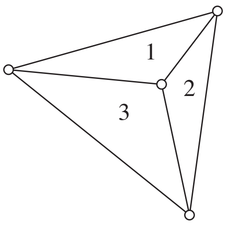
2. Pizza (coefficient 2)

Matthew bought a large rectangular pizza measuring 24 cm by 40 cm.

He divides the entire pizza into eight identical rectangular pieces (therefore exactly superposable), for him and for his seven friends.

How many possible choices are there for the shape of the pieces?

3. Triangles (coefficient 3)

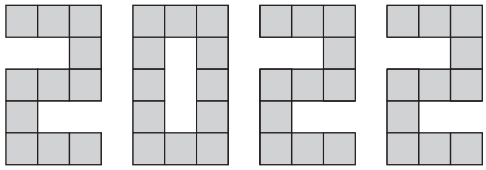


By placing four points on a plane and connecting some of them with straight line segments which never intersect, one can form a maximum of three triangles which do not overlap, as in the figure (the large triangle which is divided into three smaller triangles is not counted).

By placing 6 points on the plane, what is the greatest number of non-overlapping triangles one can form?

Note: A triangle cannot be flat.

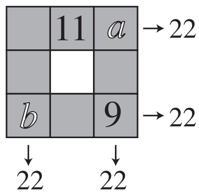
4. Cut that out! (coefficient 4)



Matilda collected these large cardboard digits. She wants to cut them out and put the pieces together to form a rectangle, with no overlaps and no gaps between the pieces. Each of the 45 small squares measures 1 dm on a side. As the cardboard is very thick, Mathilde wants to cut as little cardboard as possible.

What length of cardboard will she cut, at a minimum?

5. Around the Square (coefficient 5)



We want to place the eight numbers from 4 to 11 in the boxes around this square (9 and 11 are already placed) so that the sum of the numbers placed in each row and column indicated by the arrows is equal to 22.

Which numbers will be in boxes *a* and *b*?

END for CE PARTICIPANTS

6. Ludiland (coefficient 6)

In Ludiland, the currency is the ludic. Any purchase is made using coins of value 29 ludics and all prices can be paid exactly with these coins.

Ludovic bought a game for less than 450 Ludics. The price of the game in Ludics was a number all of whose digits are even.

How many coins did Ludovic use to pay for his game?

Remember that the even digits are 0, 2, 4, 6 and 8.

7. Just Three Letters (coefficient 7)

MAI
+ MIA
= AIM

In this cryptarithm, the same letter always replaces the same digit, and different letters always replace different digits.

What is the number represented by MAI + MIA + AIM?

8. Insomnia (coef. 8)

In a village, at each complete hour, the belltower sounds twice the number of strokes corresponding to the time in hours. It also sounds during each hour: 1 stroke after 15 minutes elapsed, 2 strokes after 30 minutes and 3 strokes after 45 minutes.

Between midnight and 7 a.m., Alice was awakened at the very first sounding of the first series of strokes marking a full hour and went back to sleep just before a new sounding (of a full hour, or of 15, 30 or 45 minutes elapsed). In this waking period, she counted 37 strokes in total.

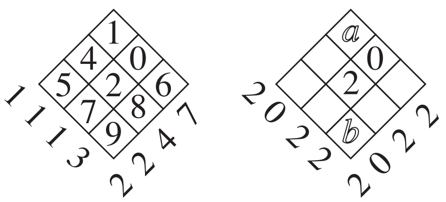
For how long was she awake?

Give the answer in hours and minutes.

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. The Year Grid (coefficient 9)

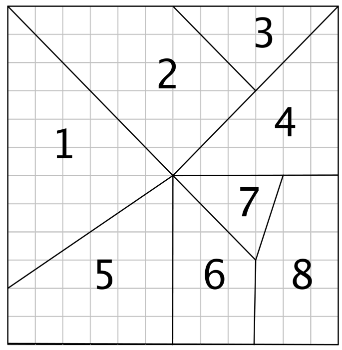


In the boxes of the left grid are digits from 0 to 9, except 3, together with the sums of the three-digit numbers read in two directions: 541 + 720 + 986 = 2247 and 106 + 428 +579=1113.

We want to arrange the same digits in the boxes of the right grid (0 and 2 are already placed) to obtain 2022 by adding the three-digit numbers in the same way.

Which digits will be in boxes *a* and *b*?

10. Benjamin's Puzzle (coefficient 10)



Benjamin found this puzzle in his attic. He removes a number of pieces from the puzzle and finds that the remaining pieces have a total area equal to half that of the complete puzzle.

Which pieces did Benjamin remove?

Give the piece numbers in ascending order.

11. Add to the Multiplication(coef.11)

$$975 \times 1970 = 2{,}022{,}002$$

This multiplication is incorrect!

By adding the same positive number to 975, 1970 and 2,022,002, we can make it correct.

What number should be added?

END for C1 PARTICIPANTS

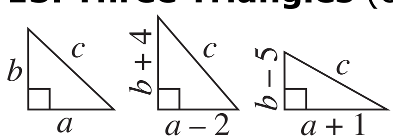
12. Eight Divisors (coefficient 12)

Lisa had fun adding the numbers from 1 to 19 and found that the number obtained, 190, has eight divisors (1, 2, 5, 10, 19, 38, 95 and 190).

Hugo did the same thing by adding all the numbers from 1 up to some number smaller than 19, and his result also has exactly eight divisors.

What is the number Hugo found that also has eight divisors?

13. Three Triangles (coefficient 13)



These three right triangles have hypotenuses of the same length c. The lengths of their perpendicular sides are: a and b; $a-2$ and $b+4$; $a+1$ and $b-5$.

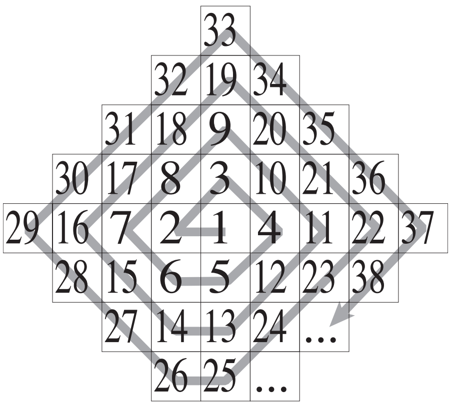
What is $a + b$?

14. Composite Numbers (coef. 14)
The number 60 is divisible by all integers from 1 to 5.
But it is also divisible by all integers from 1 to 6.
We are looking for a number that is both:
• the smallest number divisible by all the integers from 1 up to a certain number *n*;
• and the smallest number divisible by all the integers from 1 to *n+3*,
with *n* being itself the smallest possible, but strictly greater than 1.
What is this number?

END for C2 PARTICIPANTS

15. Mr. Modulus' Number (coef. 15)
Mr. Modulus has found a number smaller than 1,000 such that the remainders of the division of this number by 2, 3, 5, 7, 11, when added, total to 22.
What is his number?

16. Spiral (coef. 16)

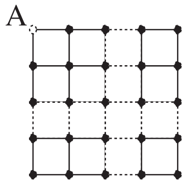


In this spiral, the number 36 is located just above the number 22.

What is the number just above 2022?

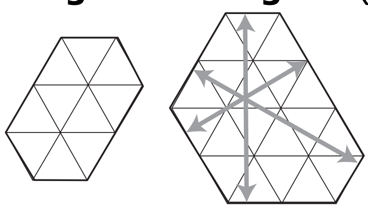
END for L1, GP PARTICIPANTS

17. Orchard (coefficient 17)



Mr. Apple would like to plant fruit trees on a square plot of 60 m on each side, placed regularly on all the vertices of a regular grid formed by whole squares occupying the entire plot and including at least four squares. The horizontal or vertical distance between the trees must be a whole number of metres of at least 3 m.
What distance between neighbouring trees must he choose to be able to see more than 58% of all his trees from point A?
Note: The diameter of the trunks of young trees will be considered negligible and the tree located at A will not be counted among the trees visible from A, but it will be counted in the total number of trees on the land.

18. Equiangular Hexagons (coef. 18)



By sticking identical equilateral triangles on a sheet of paper, Matthew has fun building convex hexagons, without holes, whose angles all measure 120° .
He has 322 triangles.
Using them all, Mathias constructs a convex hexagon, his paper support allowing him to glue no more than 20 rows of triangles in any of the three directions indicated by arrows in the right-hand figure.
What are the lengths of the six sides of this hexagon, the unit of length being that of the side of a small triangle?
Give the six lengths arranged in ascending order.

END for L2, HC PARTICIPANTS

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