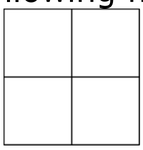
40th FFJM CHAMPIONSHIP - INTERNATIONAL FINAL – SUN. 26 JUL 2026

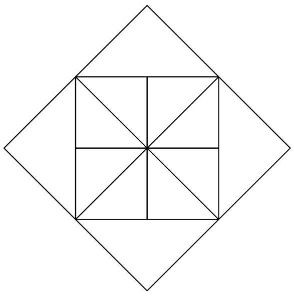
Information and results at http://www.ffjm.org/

START for ALL PARTICIPANTS

1. SQUARES (coefficient 1)
Alice asks Bob to count the number of squares in the following figure.

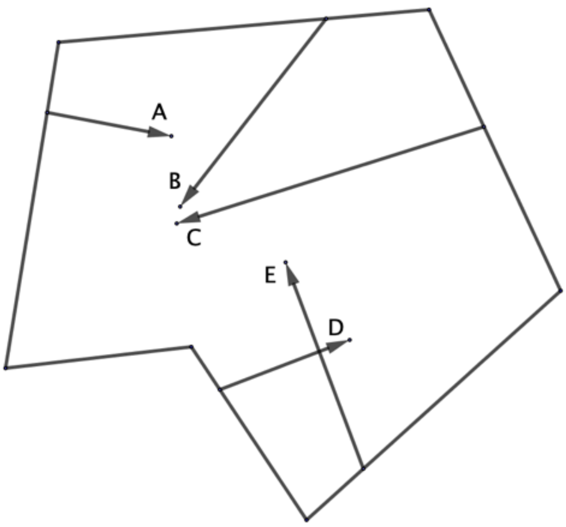


Bob correctly replies that there are five squares in the figure: one larger one that contains four others. Bob then draws the following figure, asking Alice the same question.



How many squares can be counted in the second figure?

2. AEROPLANE FLIGHTS (coefficient 2)
Matilda is lying on the ground to observe the sky and looks at a section bounded by the shape shown in the figure.

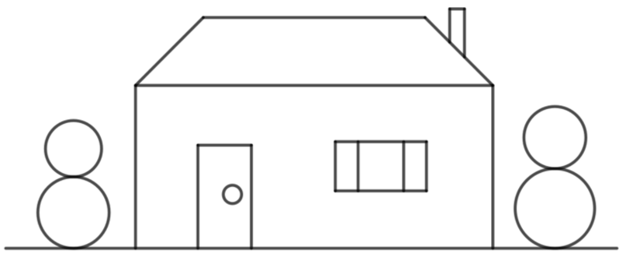


She sees 5 aeroplanes passing through her field of vision, and the vapour trails they leave behind them. The airplanes are all flying at the same apparent speed.
In what order will Matilda see these airplanes disappear from her sight?
Give the letters of the aeroplanes from the first one to disappear to the last.

3. COMBINATION LOCK (coefficient 3)
Matthew wants to put a 5-digit code on his new combination lock with the following conditions:
• the code is in the form: *ABABA*;
• the sum of the 5 digits must equal 26.
How many different codes can Matthew choose?

4. DIGITS OF 2026 (coefficient 4)
Using the four digits of 2026 (one 0, two 2s, and one 6), Matilda writes the smallest possible number (which must not begin with 0) and the largest possible number.
What will be the difference between these two numbers (the larger minus the smaller)?

5. COLOURED PENCILS (coefficient 5)
Lily wants to recreate the following image using several coloured pencils. She wants to never draw over a line more than once, and each time she has to lift her pencil to start from another point, she changes pencils so that she no never uses that colour again.
What is the minimum number of pencils she will need?

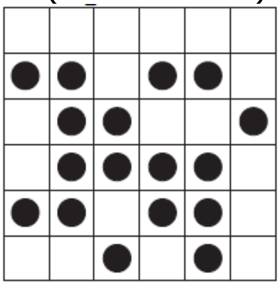


END for CE PARTICIPANTS

6. MID-RANGE RUNNER (coefficient 6)
Alice registered for a cross-country race with between 2 and 20 participants. Bib numbers are assigned in order of registration, starting with number 1. Alice notices that the sum of the bib numbers of those who registered before her is equal to the sum of the numbers of those who registered after her.
What is her bib number?

7. BI-COLOURED CUBE (coefficient 7)
Each year, Alice receives a cube in which each face is coloured one of her two favourite colours: blue and red. The first year, the cube is entirely blue, while the second year, it has one blue face and five red faces. All the faces are always coloured either blue or red, and the cubes are always different, meaning their pattern cannot be obtained from any other by rotating in any way.
For how many years can Alice receive this type of gift?

8. 17 PIECES (coefficient 8)



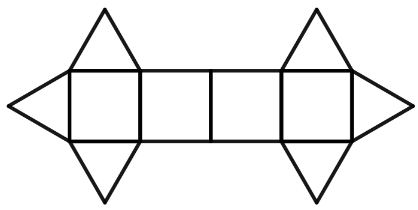
What is the minimum number of pieces that must be moved to ensure that no two pieces are adjacent horizontally or vertically?
A piece can only be moved one square to an adjacent square that shares a side with the starting square.

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).

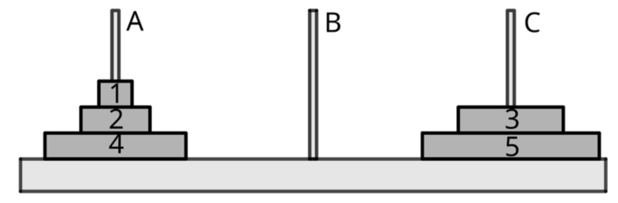
9. RAILWAY CROSSING (coefficient 9)
By train, Milan and Mathsville are 960 km apart. A first train leaves Milan for Mathsville at 09:45, traveling at 160 km/h. A second train will leave Mathsville for Milan, traveling at 240 km/h.
At what time must it leave so that the two trains meet at the mid-point between the cities?

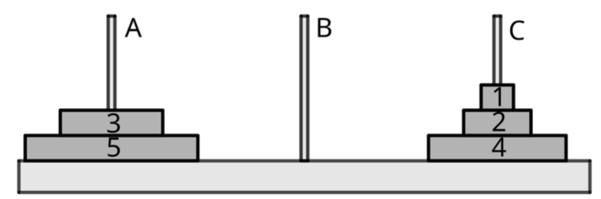
10. MONDO (coef. 10)
Alice and Bob are playing Mondo: the playing field is made up of four squares and six equilateral triangles, all with sides of 50 cm, which are drawn on the ground without overlapping.
Bob draws the playing field shown, from among the many possible layouts: the perimeter is 8 m while the total length of the lines drawn is 12.5 m.



During the night, the rain washes everything away, but the next day, Alice draws another playing field, again with four squares and six equilateral triangles with sides of 50 cm, which this time has a perimeter of 5 m.
What is the total length, in metres, of the lines drawn by Alice?

11. TOWERS OF HANOI (coefficient 11)
The Towers of Hanoi game consists of discs of different diameters and three pegs. The discs can be moved from one peg to another while respecting the following two rules:
• only one disc can be moved at a time;
• a larger disc can never be placed on a smaller disc.
Here are two possible configurations of the discs:

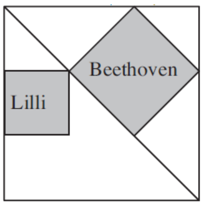




What is the minimum number of moves required to move from one to the other?

END for C1 PARTICIPANTS

12. QUADRATO PARK (coefficient 12)
In Quadrato Park, represented by the large square in the figure, there are two square dog zones, in grey, which share a common corner. Lilli, a small cocker spaniel, likes to walk in the smaller of the two squares. Beethoven, a Saint Bernard, likes to get up to mischief in the bigger.



The area of Lilli's square is 2026 m².
What is the area, in m², used by Beethoven?

13. THE BOY AND HIS PETS (coef. 13)
Matty has a tortoise and a dog. A tortoise ages twice as slowly as a human, and a dog three times faster than a human. That is to say, when a human has aged 10 years, in the same time a tortoise will have aged 5 tortoise-age units, while a dog will have aged 30 dog-age units.

When Matty is asked his age, he answers: "When my dog was born, my age in years was equal to my tortoise's age in tortoise-age units. When my animals were the same age, each in its age unit, I was 14 years old. Currently, my age in years is equal to the average age of my animals, each in its age unit."
How old is Matty (in years and months)?

14. SHADOK CHEMISTRY (coef. 14)
On the planet Shadok, there are four types of molecules: GA, BU, ZO, and MEU, which can be transformed through three types of chemical reactions:
• Four GA molecules yield two BU molecules and one ZO molecule;
• Four BU molecules yield two GA molecules and one ZO molecule;
• Four ZO molecules yield one GA molecule, one BU molecule, and one MEU molecule.
In summary:
1) 4 GA → 2 BU + 1 ZO;
2) 4 BU → 2 GA + 1 ZO;
3) 4 ZO → 1 GA + 1 BU + 1 MEU.
Professor Shadok begins a series of reactions with 2026 GA molecules.
What is the maximum number of MEU molecules there will be when the reactions stop?

END for C2 PARTICIPANTS

15. QUADRATIC EQUATION (coef.15)
An equation is of the form: $x^2 - ax - 152 = 0$ and we know that a is a positive integer, and that there are two integer solutions.
What is the value of *a*?

16. THREE WOMEN AND A BICYCLE (coefficient 16)
Three sporty friends need to get to the railway station as quickly as possible.
Wendy and Wilma walk briskly, and Renee runs.
They also have a bicycle, just one between the three of them, which they can share along the way to save time. For example, one of the walkers can start on the bicycle, then leave it halfway so the other walker can pick it up and finish the journey by cycling.
We assume that the bicycle is unlikely to be stolen, and that getting on or off the bicycle doesn't waste any time. We also know that:
• Wendy and Wilma walk at 6 km/h;
• Renee runs at 12 km/h;
• when they are cycling, each of them rides at 30 km/h.
If the station is 22 km away, what is the minimum time it will take for all three of them to arrive?
Give the answer in minutes and seconds, possibly rounded to the nearest second.

END for L1, GP PARTICIPANTS

17. INFINITELY NESTED ROOTS (coefficient 17)

For any integer n from 1 onwards, we define:

$$a_n = \sqrt{n + \sqrt{n + \sqrt{n + \sqrt{n + \sqrt{\ldots}}}}}$$

where the square roots continue indefinitely.

The number a_1 is not an integer, nor even a rational number: it is $(1 + \sqrt{5})/2$.

The number a_2 is the first integer in the sequence.

What value of n corresponds to the 2026th integer in the sequence (a_n)?

Answer 0 if the sequence contains fewer than 2026 integers.

18. ON THE OCEAN (coefficient 18)

A cargo ship is anchored at a point in the North Atlantic Ocean located on the 45th parallel, that is, exactly halfway between the North Pole and the equator. It sails successively 1000 km west, then 1000 km south, then 1000 km east, then 1000 km north.

How far from its starting point is it?

Give the answer in km, rounded to the nearest whole number.

The Earth's surface is considered a perfect sphere with a circumference of 40,000 km. If necessary, use 1.414 for √2 and 2.236 for √5.

END for L2, HC PARTICIPANTS