

FSJM – SEMI-FINAL- 16 MARCH 2024

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

START for ALL PARTICIPANTS

1. Coloured Boxes (coefficient 1)

1	4	7
9	5	3
6	8	2

You are asked to colour three boxes of this grid while respecting two rules:

- in each row and in each column, there must be only one coloured box;
- the sum of the numbers in the three coloured boxes must be 15.

2. Half and Half (coefficient 2)

Sam buys apples at the market and puts them in his basket.

He meets Alice, and gives her half the apples in his basket.

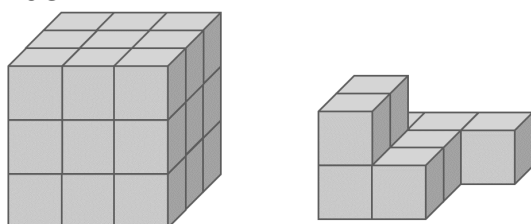
He then meets Bob, and gives him half the apples remaining in his basket.

He arrives home, and counts his apples: he has 5.

How many apples did he buy at the market?

3. From A to Z (coefficient 3)

Here are constructions made by Alex and Zoe.



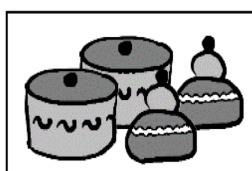
Alex built a large cube from small cubes. Zoe wants to do the same but she hasn't finished yet.

How many more small cubes does Zoe need to add?

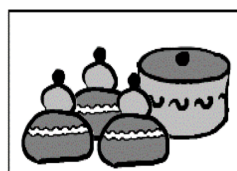
4. Birthday Cakes (coefficient 4)

Tomorrow is Nelly's birthday.

Marina buys these two boxes of cakes:



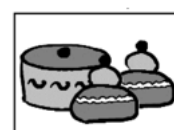
16 fr.



14 fr.

Then she buys this last box:

How much does this box cost?



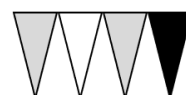
? fr.

5. Birthday Garland (coefficient 5)

Tomorrow is Joanna's birthday.

Antoine assembles triangles to make a garland.

He repeats this pattern several times:

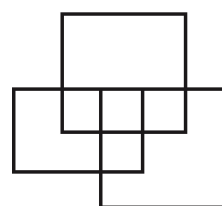


He stops, before finishing the last pattern, after he has glued his 12th grey triangle.

How many triangles did he use in total?

END for CE PARTICIPANTS

6. Rectangles (coefficient 6)



How many complete rectangles are drawn in this figure?

Be careful, squares are special rectangles. You have to count them!

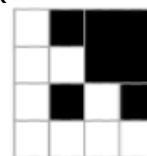
7. Squares Series (coefficient 7)



Monday



Tuesday



Wednesday

On Monday, Julia draws a square on a piece of paper.

On Tuesday, she divided her square into 4 squares. She colours the new square at the top right black.

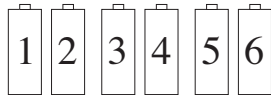
On Wednesday, she does the same for each white square, as shown in the figure. On Thursday, she does the same for each of the remaining white squares.

On Friday, she does the same for each of the remaining white squares.

How many black squares does Julia have in total on her sheet at the end of Friday?

8. Dead Batteries (coefficient 8)

Gary needs to change the two batteries in his torch. He has a box with six batteries, two of which are dead.



If he is lucky, in two tries he can find both defective batteries: for example, if the torch lights up with batteries 1 and 2, then with batteries 3 and 4, he knows that the dead batteries are 5 and 6.

If he uses the best possible method, but is very unlucky, how many tries will he need to make to find both dead batteries?

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. Matthew's Calculation (coef. 9)

"A" represents a digit other than 0, always the same. Matthew performs the following calculation:

$$\overline{AA} \times \overline{AA} + \overline{AA} + \overline{AA}$$

and the result is a number that is written with A digits. Matthew then divides this result by A.

What is the result of this division?

10. A Little Cooking (coefficient 10)

$$\text{PEA} + \text{NUT} + \text{WOK} = 2024$$

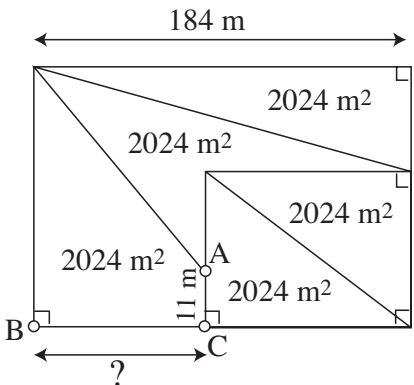
In this coded operation, each letter replaces a digit and two different digits are replaced by two different letters. This coded operation has 2160 different solutions.

But one digit does not appear in any of these solutions.

Which one?

11. Squire Irrel's Land (coef. 11)

Sq. Irrel owns a rectangular plot of land, 184 m in length, divided into five parcels each of area 2024 m².

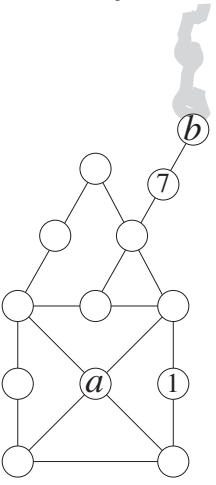


Three large oaks are found at A, B and C. **If AC = 11 m, what is the distance, in m, between the oaks at B and C?** Round the answer to the nearest m.

END for C1 PARTICIPANTS

12. Santa's House (coefficient 12)

Place the numbers 1 to 13 in the discs so that the numbers located on each straight-line segment sum to 24.



Which numbers will go into discs a and b?

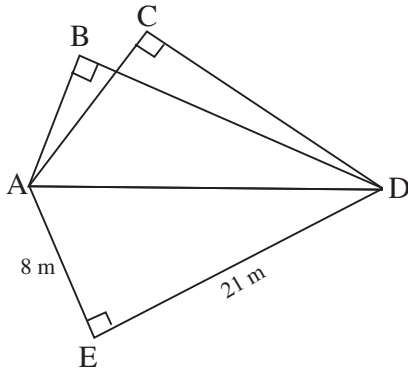
13. Bravo to Future Winners (cf. 13)

$$\begin{array}{r} \text{G R A N D} \\ + \text{B R A V O} \\ \hline = \text{X X X X X} \end{array}$$

As in any cryptarithm, each letter always represents the same digit, two different letters represent two different digits and no number begins with 0.

What is the largest possible value of GRAND?

14. Crossed Quadrilateral (coef. 14)



The figure is not to scale, but we know that:

- ABD, ACD and AED are right triangles;
- AE = 8 m
- ED = 21 m;
- AC is 2 m

longer than AB;

- BD is 4 m longer than CD.

What is the perimeter of the crossed quadrilateral ABDC?

Express your answer in metres, and round the result to the nearest metre if necessary.

END for C2 PARTICIPANTS

15. Egyptian Fractions (coefficient 15)

$$\frac{2}{85} = \frac{1}{\text{stain}} + \frac{1}{\text{stain}}$$

Matilda found this equality in an old notebook of her grandfather. Two different denominators are hidden by ink stains.

What is the sum of these two denominators?

16. From 23 to 2024 (coefficient 16)

Matt notices that 2024 is divisible by the prime number 23, which is $24 - 1$.

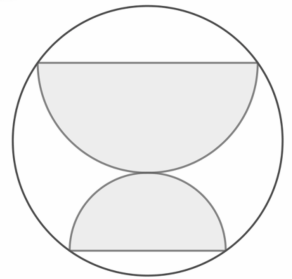
Which other year between 1000 and 2024, whose tens digit is different from 0, had the same property, that is to say that one of the prime divisors of that year is equal to the number formed by the last two digits of the year minus 1?

END for L1, GP PARTICIPANTS

17. Medals and Cups (coefficient 17)

For the 38th Mathematical Games Championship, the international federation decided to produce circular medals.

Two tangent half-discs with parallel bases are represented on each medal. The end points of the base diameters of the two half-discs lie on the boundary of the medal.



The area of the upper half-disk is exactly twice the area of the lower half-disk (the diagram is not necessarily to scale).

Find the area of the shaded part, knowing that the medal has a diameter of 8 cm.

Give the answer in mm², rounded to the nearest integer, and if necessary, take π as 3.1416 and $\sqrt{2}$ as 1.414.

18. Cavalier numbering (coef. 18)

Matilda moves a knight on a chessboard without landing on the same square twice. She numbers the squares on which the knight has been: 1 for the starting square, 2 for the next one, etc.

At one point, the knight has landed on the eight squares of the first row of the chessboard. Reading the large number formed by all the digits written in this row (reading across all the squares), she realizes that this number could not have been smaller.

What is this number?

Remember that a chess knight moves diagonally across a rectangle of two squares by three, in any direction.

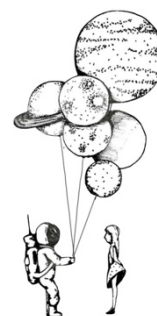
END for L2, HC PARTICIPANTS

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



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