

# FFJM – Swiss Finals – May 12<sup>th</sup> 2012

Information and rankings on <http://fsjm.ch/>

## BEGINNING OF ALL CATEGORIES

### 1 – Mathilde's footsteps (coefficient 1)

Mathilde counts the number of steps she takes to walk from home to school. Each time she takes two steps, Mathilde advances by exactly one metre. At the halfway point, she stops and thinks: "I have already taken 600 steps". **What is the distance between her house and the school ?**

### 2 – The direction of time (coefficient 2)

On his watch, it is 14:41. Philippe note it's an hour Palindromic (one reads the same time in both directions, from left to right or right to left). In how many minutes will be the next Palindromic time?

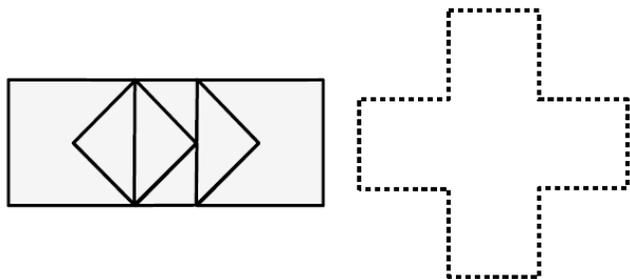
### 3 – Lucky day (coefficient 3)

Today is 12 May 2012, which can be written as 12-05-2012. If the digits of 12-05-2012 are added together, then we get :

$$1 + 2 + 0 + 5 + 2 + 0 + 1 + 2 = 13.$$

**What will be the next date at which the sum of the digits equals 2 times 13, namely 26?**

### 4 – Make a plus with a minus (coefficient 4)



The "-" sign on the left has been cut into seven pieces. **Use these pieces to reconstitute the "+" sign on the right.**

### 5 – Calculation of the year (coefficient 5)

1 2 3 4 5 6 7 8 9

**By inserting "+" or "-" signs between certain digits, create a calculation whose result is 2012.**

## END OF CATEGORY CE

### 6 – Birthdays (coefficient 6)

Each person in a group has added together the number of the date of his birthday and the number of the month of his birthday. They have all obtained the same number, strictly greater than 34, but no one has the same birthday as anyone else.

**What is maximum possible number of people in the group ?**

### 7 – Father and son (coefficient 7)

A father tells his son: "In four years, I will be five times older than you!"

His mother adds: "Yes, and in 22 years, Dad will be only twice as old as you!"

**How old are the father and the son now ?**

### 8 – Multiplication (coefficient 8)

In this multiplication, where the digit 7 is given, each symbol always represents the same digit, and two different symbols represent two different digits.

$$\begin{array}{r} \clubsuit \spadesuit \heartsuit \clubsuit \\ \times \quad 7 \\ \hline = \clubsuit \spadesuit \spadesuit \clubsuit 7 \end{array}$$

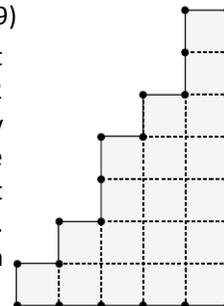
**What is the result of the multiplication ?**

## END OF CATEGORY CM

*Problems 9 to 18 : Careful! In order for a problem to be completely solved, you must provide the number of solutions it has, give the solution if it has only one, and give two solutions if it has more than one. For those problems having several solutions, enough space is provided to write two solutions (but it is possible that there is only one!).*

### 9 – Mathilda's splitting (coefficient 9)

Mathilde mentions to Mathias that it is possible to cut this figure into 2 pieces of the same area by connecting 2 points on the boundary by a line segment (without leaving the shaded region). After a few seconds, Mathias finds a solution.



**Do the same yourself !**

### 10 – A surprising average (coefficient 10)

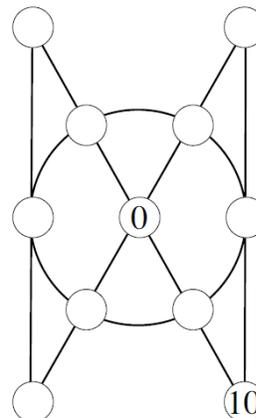
An integer is written with three different nonzero digits ♠ ♣ ♦. The digit ♠ is the hundred's place, ♣ is the ten's place and ♦ is in the unit's place.

Surprise ! The number ♠ ♣ ♦ is the average of the numbers ♣ ♦ ♠ et ♦ ♠ ♣ .

**Find the number ♠ ♣ ♦.**

### 11 – From 0 to 10 (coefficient 11)

**Fill in the boxes of this diagram with the numbers from 1 to 9 in such a way that the two columns of three boxes, the two diagonals of five boxes and the six boxes of the circle all give the same sum.**

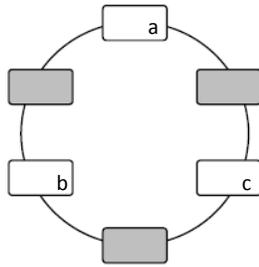


## END OF CATEGORY C1

**12 – Quadrature of circle** (coefficient 12)

Put a non-zero natural number in each white box, in such a way that their sum is as small as possible.

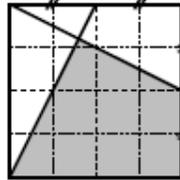
The number in box (a) should be strictly less than the number in box (b), which should be strictly less than the number in box (c).



Each grey box hides the sum of the two numbers that are directly connected to it by an arc of the circle, and this sum should be a perfect square.

**13 – A piece of square** (coefficient 13)

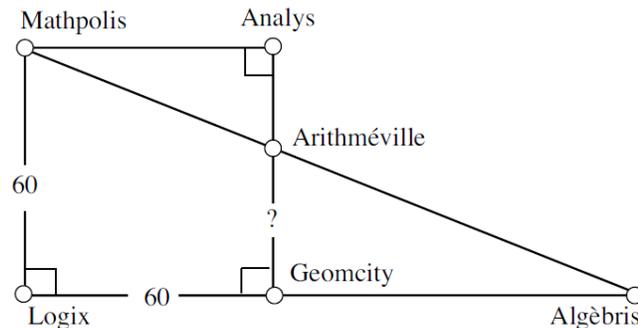
On the adjacent square, there are two line segments drawn, each joining one of the corners of the square to the midpoint of one of the sides. This determines a grey shaded region.



What is the exact proportion of the grey area relative to the total area of the square?

Write your answer as a fraction in lowest terms.

**14 – The road map** (coefficient 14)



The figure above is a road map, where distances are measured in kilometres.

The cities Mathpolis, Analys, Geomcity and Logix are located at the vertices of a square of side 60 km.

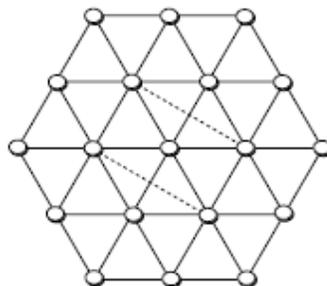
Analys, Arithméville et Geomcity lie on a straight line. Logix, Geomcity et Algèbris too.

Knowing that the distance Arithméville-Algèbris is 91 km, find the distance between Arithméville and Geomcity ?

END OF CATEGORY C2

**15 – No more rectangle** (coefficient 15)

The figure shows a lattice composed of 24 small equilateral triangles. Someone has placed a pebble on each of the 19 vertices. It is possible to choose 4 pebbles on this figure lying at the vertices of a rectangle, two opposing sides of which are solid lines (see the example shown in the diagram).

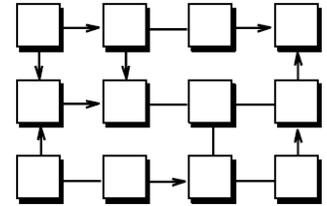


Counting all sizes and orientations, there are exactly 45 different rectangles of this type.

What is the minimum number of pebbles you can remove so that none of these 45 rectangles remain ?

**16 – Auto-circuit** (coefficient 16)

Write a number from 1 to 6 in each box.



Each of the six numbers must be used twice, and connected once (by a line segment or an arrow) to each of the other numbers.

Each arrow must point toward the larger of the two numbers it connects.

END OF CATEGORIES L1, GP

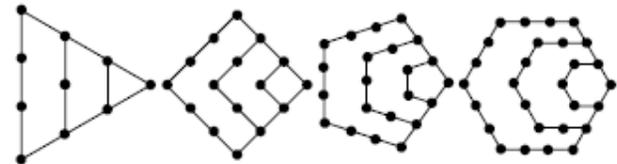
**17 – Polly Gone's Forest** (coefficient 17)

When Polly Gone was one year old, her family planted a tree in the forest.

When Polly Gone was two years old, they planted some more trees so as to form a regular N-sided polygon, with two trees per side, where one of the vertices was the original tree.

When Polly Gone was three years old, her family planted more trees, so as to form a new regular polygon, still with N sides, with three trees per side, two of the sides extending two sides of the previous polygon.

And so on.



The above figure shows, in the cases where N=3, 4,5 and 6, the successive forests up to the age of four years.

As of today, Polly Gone's family has planted 1216 trees since she was born.

What is the value of N, and how old is Polly Gone ? (She is strictly more than 4 years old.)

**18 – The sequence of the year** (coefficient 18)

The first term of a sequence is 1, and the second is 2012. Thereafter, each term is the sum of the two preceding terms.

What is the remainder when the 2012th term of the sequence is divided by 2012 ?

END OF CATEGORIES L2, HC