

START - ALL PARTICIPANTS

1 – THE REARVIEW MIRROR (Coefficient 1)

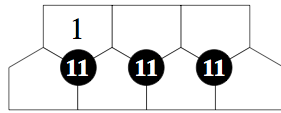
Mathilde has just received a new bicycle equipped with a rearview mirror. While trying her bicycle, she sees a sportscar arriving behind her and, without turning around, she sees the following number on the license plate in her rearview mirror :



What is the number written on the license plate?

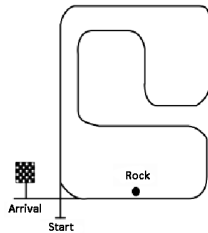
2 – THE 7 BRICKS (Coefficient 2)

One wishes to write the numbers from 1 to 7 inside the seven bricks of the picture (the number 1 is already placed), so that the three bricks surrounding each black disk contain numbers whose sum is always equal to 11. **Place the numbers from 2 to 7.**



3 – THE CIRCUIT (Coefficient 3)

During a trial run on the Mathville car racing circuit, pilot Bastien Mob started from the start line and performed a certain number of laps before exiting the circuit towards the arrival. During his run, Bastien turned his wheel to the right a total of 111 times.

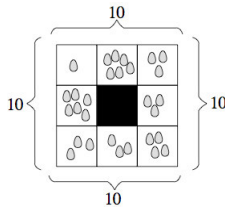


How many times did he pass next to the rock (at the lower right on the picture)?

Note: between two turns, Bastien always sets the wheels straight again before starting a new turn.

4 – THE HEN HOUSE (Coefficient 4)

Eustache owns hens who lay eggs every morning in the 8 boxes of the henhouse. The hens always manage so that Eustache can count exactly 10 eggs along each edge of the henhouse. In the example shown on the picture, the hens have laid a total of 29 eggs.



What is the minimum number of eggs that the hens must lay so that each box contains at least one egg and each edge of the henhouse contains exactly 10 eggs ?

5 – DIE TELEFONE (Coefficient 5)

Laurent and Michelle own a phone store. On Thursday December 29, 2011, in the early morning, Laurent looks at the accounting. They had sold 13 phones on the previous day (Wednesday), and only one on Thursday morning so far. The following day Friday, in the late morning, Michelle looks at the accounting. They had eventually sold a total of 15 phones on the previous day (Thursday), and 4 on Friday morning.

The total number of phones sold so far for the whole month of December at that point was 218 phones.

What was the total number of phones sold for the month of December when Laurent looked at the accounting?

END FOR CE PARTICIPANTS

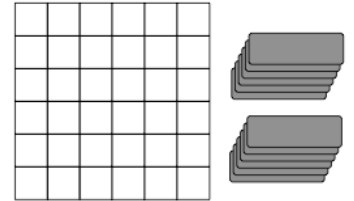
6 – AFTERTHOUGHT (Coefficient 6)

Mathias thinks of a number, multiplies it by 3, adds 792 to the result, divides the resulting number by 144, and obtains an exact quotient (there is no remainder). Then Mathias subtracts 2 from that result, and finally multiplies the answer by 100 000. He finds one million.

What was the number he thought of initially ?

7 – TRIMINOS (Coefficient 7)

Mathias places triminos on the board, each trimino covering exactly three empty cells of the board along a straight line (horizontally or vertically). At a certain point he stops because he cannot pose any more triminos. However there are still many empty cells left. **How many, at most?**



8 – THE OLD CALCULATOR (Coefficient 8)

Mathias has found the old calculator that his father used in school. Only four of its keys still work: the "3" key, the "5" key, the "+" key, and the "=" key. When he switches it on, the calculator displays "0".

How many times will he need to press keys, at least, before the calculator will display "2012" ?

Note: he will press the "=" key only once, just before displaying the final result.

END FOR CM PARTICIPANTS

Problems 9 to 18: beware! For a problem to be completely solved, you must give the number of solutions, AND give the solution if there is only one, or two solutions if there is more than one. For all problems that may admit more than one solution, there is space for two answers on the answer sheet (but there may still be a unique solution).

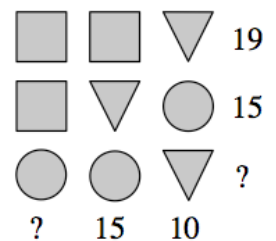
9 – SELF-REFERENCE (Coefficient 9)

Complete the sentences in the frame with numbers (written in digits) so that they are true .

1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 – 11 – 12
 This frame contains a total of ... numbers.
 Among them ... are multiples of 5.

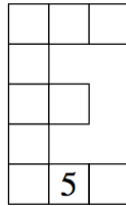
10 – SYMBOL GUESSING (Coefficient 10)

Each symbol always represents the same digit. Each number to the right of a row indicates the sum of the three digits in that row. Each number at the bottom of a column indicates the sum of the three digits in that column. **Find the two missing numbers.**



11 – THE MAGIC "E" (Coefficient 11)

Complete the squares of this E-shaped diagram using numbers from 1 to 10 (5 is already placed) so that:

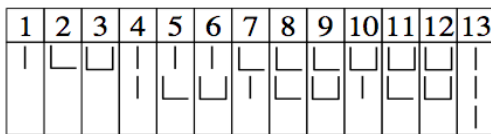


- the sums of the numbers contained in the two rows of length 3, the row of length 2, and the column of length 5 are all equal to each other;
- in each of the two rows of length 3 and the row of length 2, the numbers are in increasing order from left to right.

END FOR C1 PARTICIPANTS

12 – EDGES AND THAT'S ALL (Coefficient 12)

Charles writes successive numbers using three basic symbols which consist of 1 edge, 2 edges, or 3 edges in the following manner.



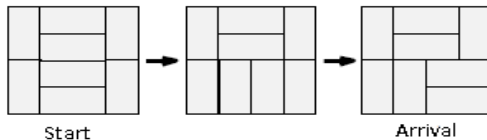
After 312 edges, his pen runs out of ink. **What is the last number that Charles managed to write completely?**

13 – SUM OF THE DIGITS (Coefficient 13)

The sum of the digits of a number N is equal to 1012. The sum of the digits of a number P is equal to 2012.

What is the smallest possible value of the sum of the digits of the number N+P ?

14 – ROTATE-DOMINOS (Coefficient 14)



Rotate-dominos is a game played with 8 identical 1x2 dominos. These dominos must always tile a 4x4 square grid, without overlapping nor leaving gaps. The goal is to start from a given randomly chosen tiling and arriving at another given randomly chosen tiling using the minimum number of moves. Each move consists of:

- choosing two dominos which share one of their long edges (along the entire edge) (this is always possible);
- rotate them by 90 degrees

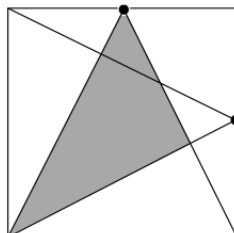
The figure illustrates a sample where the necessary number of moves is 2.

What is the maximum possible number of moves needed?

END FOR C2 PARTICIPANTS

15 – AREA GUESS (Coefficient 15)

The black circles of the figure are located at the midpoints of the consecutive edges of a square. The edges of the gray triangle all have integer lengths (in centimeters).

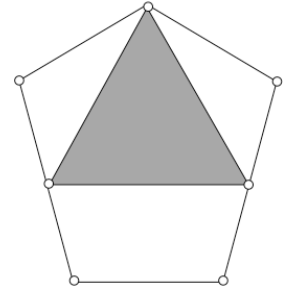


What is the minimum surface area of the square (in square centimeters)?

16 – THE KNIGHT'S HELMET

(Coefficient 16)

The figure is symmetric about the vertical axis and represents a knight's helmet.



The vertices of the large pentagon lie on a same circle. The three shortest edges of the pentagon have a length equal to the radius of the circle, namely 25 cm.

The gray triangle represents the visor of the helmet. Its two lowermost vertices are the midpoints of the two long edges of the pentagon, while the uppermost vertex coincides with the uppermost vertex of the pentagon.

What is the area of the visor, expressed in cm² and rounded to the nearest cm² ?

If necessary, take 1.414 for $\sqrt{2}$, 1.732 for $\sqrt{3}$ and 2.236 for $\sqrt{5}$.

END FOR L1 AND GP PARTICIPANTS

17 – THE SEQUENCE OF THE YEAR (Coefficient 17)

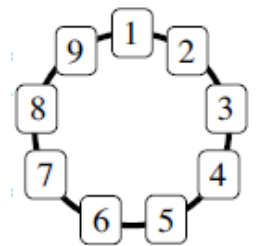
One draws at random an infinite sequence of digits 0, 1 or 2. Then one reads it in the order of the draw.

What is the probability that one reads "2 0 1 2" without having previously read "0 1 2" ?

Give your answer as an irreducible fraction.

18 – JOSEPH'S GAME (Coefficient 18)

Joseph's game is played by going clockwise around a circle on which cards numbered from 1 to N are initially laid out in order.



The figure shows the case N=9 of this game. One starts with card number 1, which one removes, then going

around the circle clockwise one removes every third card encountered. Thus one removes in this order the cards numbered 1, 4, 7, 2, 6, 3, 9, 5, and at the end of the game the last remaining card is 8.

If N=2012, what is the number of the card eliminated just after card number 2012?

Answer 0 if you think card number 2012 is the last card remaining at the end of the game.

END FOR L2 AND HC PARTICIPANTS