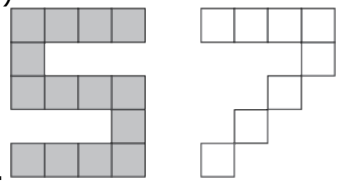
SEMI-FINAL- 21 MARCH 2020

START for ALL PARTICIPANTS

1. Favourite digits (coef. 1)



Matilda et Matthew have 5 and 7 as their favourite digits. They drew these two figures using identical small squares.

If we place the 7 on the 5 to hide as many grey squares as possible, how many of these will remain visible?

We can turn or invert the 7 figure before placing it on the 5 figure.

2. The clocks (coefficient 2)

We took pictures of these five clocks at the same time. On each of them, the first two digits correspond to the hour and the last two to the minutes. One is 10 minutes fast, another 5 minutes fast, a third 15 minutes slow, and a fourth was stopped. Only one indicated the exact time.

What time was it ?

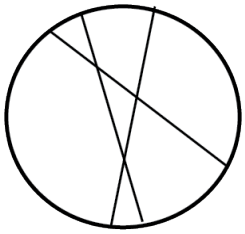
3. Make 33 (coefficient 3)

Matilda notices that by adding the number of her house and that of her cousin Matthews' house, she gets 33.

We know that the number of Matilda's house is smaller than that of Matthew's, but this alone does not allow us to know the two numbers.

How many possibilities are there?

4. A badly cut pizza (coefficient 4)



Matthew wanted to cut a pizza with a large knife. In three strokes, he cut the pizza into 7 parts, very unevenly.

If he makes a fourth straight cut, how many pieces will he get at most?

5. From 1 to 8 (coefficient 5)

1			
		2	3

Matilda wants to place the numbers from 1 to 8 in this grid so that:

- the sum of the two numbers in each column is the same;
- the sum of the four numbers in each row is the same.

The numbers 1, 2 and 3 are already placed. You must place 4, 5, 6, 7 and 8.

What number will be the grey box?

END for CE PARTICIPANTS

6. The two rectangles (coefficient 6)

Matthew has cut two rectangles 17 cm wide and 20 cm long, one from a sheet of white paper and the other from a sheet of red paper.

He turns the white rectangle a quarter of a turn and places it on the red rectangle so as to hide the maximum of red.

What is the area in cm² of the red surface that remains visible?

7. The puzzles (coefficient 7)

A puzzle maker makes two types of puzzles. From a wooden panel, he can make either 100 copies of the first type, or 80 copies of the second type. In each case, the entire panel is cut and there is no wastage. One puzzle type is 50 grams lighter than the other.

What is the weight in kg of the wooden panel?

8. Double substitution (coefficient 8)

A digit is always represented by the same symbol. ♣♣ × ♦♦ = ♥♥♠♠

A symbol always represents the same digit. The four symbols replace four different digits.

What number is represented by: ♥♥♠♠ ?

END for CM PARTICIPANTS

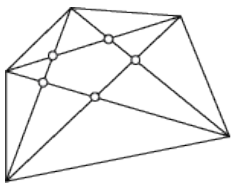
<u>Problems 9 to 18</u>: beware! For a problem to be completely solved, you must give both the number of solutions, AND give the solution if there is only one, or give any two correct solutions if there are more than one. For all problems that may have more than one solution, there is space for two answers on the answer sheet (but there may still be just one solution).

9. Apples (coefficient 9)

Matilda has more than one apple but fewer than two hundred in a shopping cart. If she fills boxes at 12 apples per box, there is one left over. If she were to put 14 apples per box or 21 apples per box, she would likewise have one left over.

How many apples are there in Matilda's shopping cart?

10. Diagonals (coefficient 10)



Matthew has drawn an irregular pentagon and notices that the diagonals intersect at 5 points inside the pentagon.

How many intersection points of diagonals will there be at most if he draws an irregular heptagon?

A heptagon is a 7-sided polygon.

11. Amelia's calendars (coefficient 11)
Young Amelia has a stock of 2020 calendars that were not sold at the start of the year.
For which future year of the 21st century could she put them back on sale by changing only the number of the year?
Remember that the 21st century runs from January 1, 2001 to December 31, 2100 and that the leap years of the 21st century are those whose year is a multiple of 4, but is not a multiple of 100.

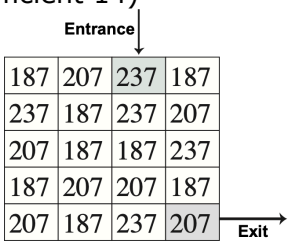
END for C1 PARTICIPANTS

12. Tetrahedron (coefficient 12)
Ben would like to build a "die" as a regular tetrahedron.
On each side there must be a number from 1 to 9 with the following three conditions:
- the four numbers are all different,
- the sum of the 4 numbers must be equal to 20,
- none of the numbers can be consecutive.

Which four numbers are used to build this die? List the numbers in descending order.

13. A rod to be cut (coefficient 13)
Anaïs has a 20cm long rod and wants to cut it into three pieces to make the sides of an isosceles triangle that is not flattened. Each piece measures a whole number of centimetres.
How many distinct triangles can she make?

14. Amazing Sevens (coefficient 14)
In this maze, we add the points (numbers) of all the cells we pass through. We can go from one cell to another if they have one side in common. We cannot pass twice through the same cell.



Draw a path that will give us exactly 2020 points.

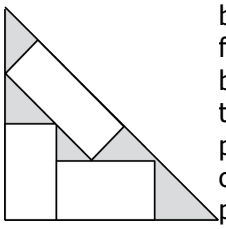
END for C2 PARTICIPANTS

15 – Heads or tails (coefficient 15)
You flip a coin ten times and note each time if it falls on the "heads" side or on the "tails" side.
What is the probability that you will get exactly as many "heads" as "tails" ?
Give the answer in the form of an irreducible fraction. Assume the coin is perfectly balanced.

16. Holiday in Syldavia (coefficient 16)
Adelaide spends her holiday in Syldavia. In this country, coins are no longer used and there are only four kinds of banknotes, which are respectively worth 63, 77, 99 and 239 crowns. Adelaide, who wants to give her sister Sophie a gift worth 2020 crowns, pays the exact amount in notes and the number of each type of note is odd.
How many notes of each value will she use?

END for L1, GP PARTICIPANTS

17. Building project (coefficient 17)
On a parcel of land in the shape of an isosceles right-angled triangle, Archie Tekte plans to build a museum, which will include three rectangular buildings arranged as in the figure. The dimensions of these buildings are not yet defined, but they will occupy the maximum possible surface and will contact one another or the edge of the parcel as shown in the figure.



Undeveloped areas will be planted. The land parcel has an area of 2020 m^2.
What will be the total area of the planted zones?
If necessary, take $\sqrt{2}$ as being 1.414.
Give your answer to the nearest 0.1 m^2.

18. Remarkable integers (coefficient 18)
Matthew has found some remarkable integers. When he calculates the square of such an integer, then replaces its first digit with this digit increased by 1 (if this first digit is between 1 and 8) or by 0 if it is a 9 (deleting any leading zeros in numbers thus formed, except for the final (units) digit), he thus obtains numbers which are still squares of integers. Three examples of remarkable integers are 24, 45 or 95.
What three-digit number is remarkable?

END for L2, HC PARTICIPANTS