

## Discovery Test 2024

Exercise 1 7 pts

### HAPPY FAMILY

Your solution is to be written in French, German, Spanish, or Italian using a minimum of 30 words.

Paulette dit : « J'ai deux sœurs de plus que de frères. »

Justin, son plus jeune frère, lui réplique : « Mais moi, j'ai deux fois plus de sœurs que de frères. »

**Combien y a-t-il de garçons et de filles dans cette famille ?  
Expliquer votre réponse.**

Paulette dice: «tengo dos hermanas más que hermanos.»

Justin, el hermano más joven, le contesta: «Pero yo, tengo dos veces más hermanas que hermanos.»

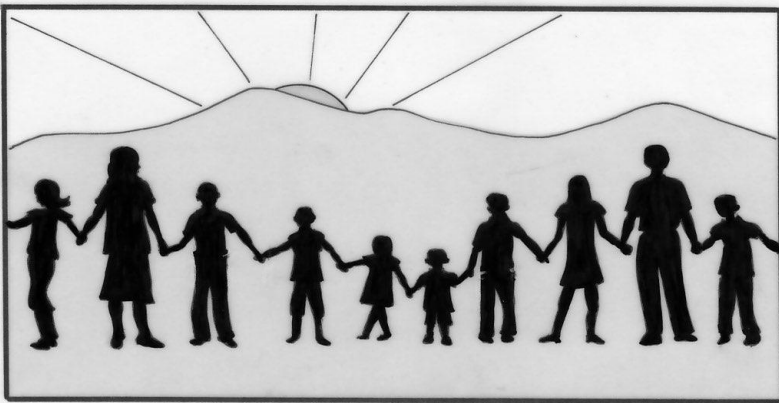
**¿Cuántas niñas y cuántos niños hay en esta familia? Justifica tu respuesta.**

Paulette sagt: „Ich habe zwei Schwestern mehr als Brüder.“ Justin, ihr jüngerer Bruder, entgegnet: „Aber ich habe doppelt so viele Schwestern wie Brüder.“

**Wie viele Jungen und wie viele Mädchen gibt es in dieser Familie?  
Erklärt eure Antwort.**

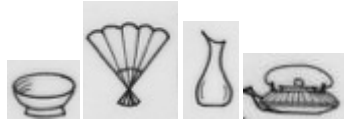
Paulette afferma : « Io ho un numero di sorelle maggiore di due rispetto ai fratelli ». Justin, il suo fratello minore, le replica: “ Io, invece, ho un numero di sorelle doppio dei fratelli.”

**In questa famiglia quanti maschi e femmine ci sono?  
Motivate la vostra risposta.**



Exercise 2    5 pts  
**TOUR OPERATOR**

The four symbols :

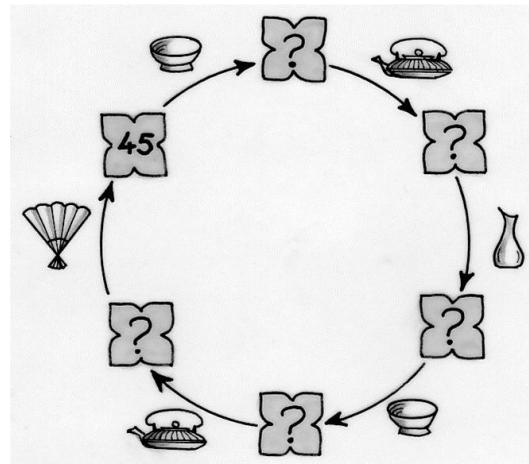


each designate one of the following four operations:

+1      × 4      ÷ 5      × 5

**Associate each symbol with its operation.**

**Complete the boxes with whole numbers.**

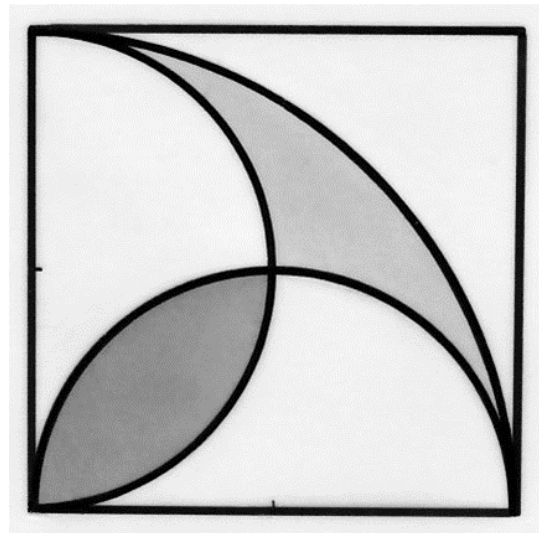


**Mathématiques**  
**SANS**  
**Frontières**

Exercise 3    7 pts  
**EQUALITY**

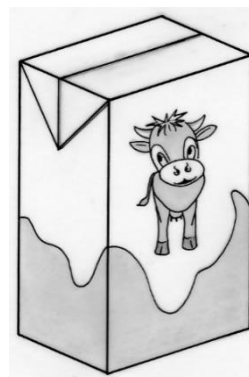
The figure opposite is made up of arcs of circles inscribed in a square. Each arc of a circle begins and ends at a vertex of the square. Their circles have as center a vertex of the square or the midpoint of one side of the square.

**Prove that the two shaded areas have equal areas.**



Exercise 4    5 pts  
**VERY GOOD**

A carton of milk has the shape of a rectangular parallelepiped whose faces have areas of 60 cm<sup>2</sup>, 105 cm<sup>2</sup> and 252 cm<sup>2</sup>.



**Determine the volume of this carton of milk.**

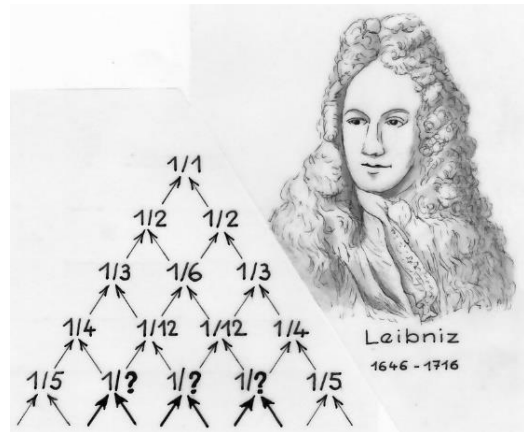
**Explain your reasoning.**

Exercise 5 7 pts

**1 - FRACTION**

Gottfried LEIBNIZ (1646 - 1716), a great German mathematician born in Leipzig, constructed the triangle opposite composed of fractions all having 1 as the numerator.

On the sides of the triangle are written the reciprocals of the integers in order. Each fraction is equal to the sum of the two fractions immediately below it.



Write this number.

**Complete the line starting with 1/5 and add the next two lines.**

**State three different fractions taken from the Leibniz triangle whose sum is 1.**

State five fractions extracted from the Leibniz triangle whose sum is 1.

Write 1 in two different ways as the sum of seven different fractions taken from the Leibniz triangle.

Exercise 7 7 pts

**AREA-GAMI**

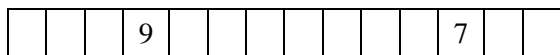
Adeline takes a rectangular sheet of paper measuring 15 cm by 10 cm and folds it diagonally along the rectangle as shown in the drawing. She obtains the figure below which she places on the table.

**Calculate the total area of the surface visible in gray.**

Exercise 6 5 pts

**DECRYPT**

Clémence's bank card number has 14 digits.

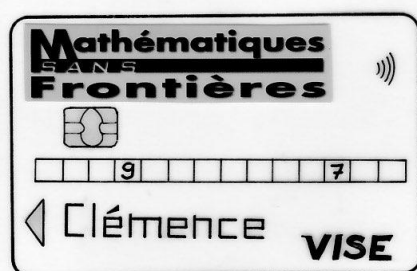
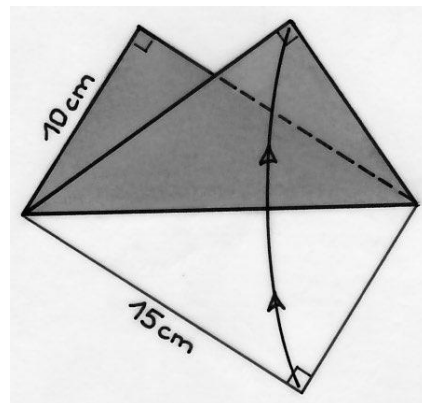


The digits have partly been erased, only two remain.

But Clémence remembers that the sum of the numbers in three consecutive boxes is always equal to 20.

**Explain how to find the number on Clémence's card.**

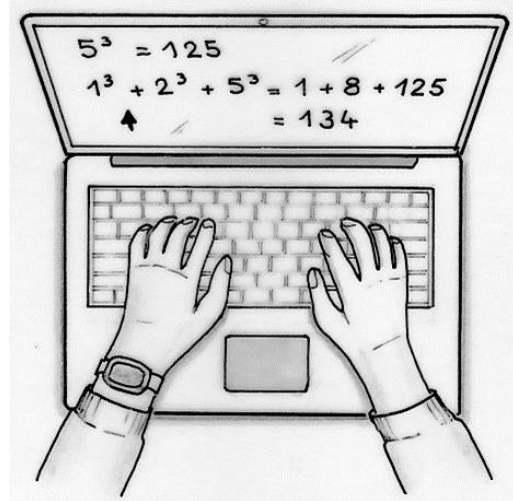
**Write this number.**



Exercise 8    5 pts  
**CUBING**

We provide the following algorithm:

- choose an integer greater than 1 and less than 10
- cube it
- calculate the sum of the cubes of the digits of the number obtained and write the result
- repeat the previous instruction until obtaining a result already written



For, example choosing 5 at the start:

- 5
- $5^3 = 125$
- $1^3 + 2^3 + 5^3 = 134$
- $1^3 + 3^3 + 4^3 = 92$
- $9^3 + 2^3 = 737$
- $7^3 + 3^3 + 7^3 = 713$
- $7^3 + 1^3 + 3^3 = 371$
- $3^3 + 7^3 + 1^3 = 371$

This algorithm allows you to obtain a three-digit number equal to the sum of the cubes of its digits.

**Find other three-digit numbers equal to the sum of the cubes of their digits.**

**M**athématiques  
SANS  
Frontières

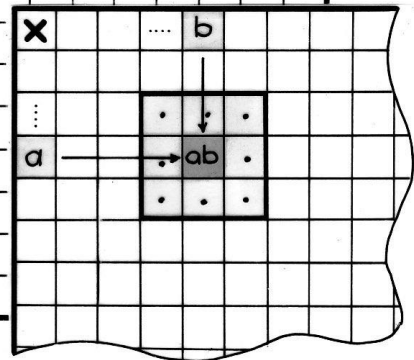
Exercise 9    7 pts  
**A TABLE!**

In the multiplication table opposite, the box at the intersection of row a and column b contains the product  $a \times b$ .

**Express, in terms of a and b, the sum of the eight boxes surrounding box  $a \times b$ .**

**Provide the details of the calculation.**

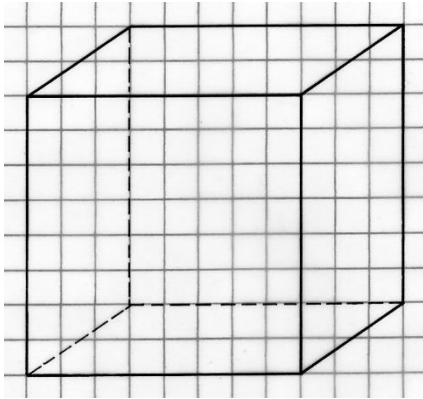
X	1	2	3	4	5	6	7	8	9	10
1										
2			→ 2×3							
3										
4										
5										
6										
7										
8										
9										
10										



72		
		130

**In this extract from the multiplication table, find the product  $a \times b$  to be placed in the central box. Give the values of a and b.**

Exercise 10    10 pts  
**WITHOUT ITS CORNERS**



Remove eight pyramids from a cube. Each pyramid has as its apex a vertex of the cube and as its base the triangle obtained by connecting the midpoints of the three edges which start from this vertex. We obtain a new polyhedron.

**Represent a cube of side 8 cm in cavalier perspective. Complete this cube with the representation of the defined polyhedron above inside the cube. How many vertices, faces and edges does this polyhedron have? Calculate the total surface area of this polyhedron.**

# SPÉCIAL SECONDE

Exercise 11 5 pts

## BUS SUB



The driver of a bus is stopped at a motorway rest area.

It is 9 a.m. and as he leaves, he notices that the odometer of his bus reads 15,951.

He immediately notices that it is a palindrome number, that is to say that it is read the same way from left to right and from right to left.

He will monitor his meter throughout the journey and it is only after an hour and 15 minutes of driving that he finds a new palindrome.

**Knowing that he did not stop, what average speed did he drive? Explain your reasoning.**

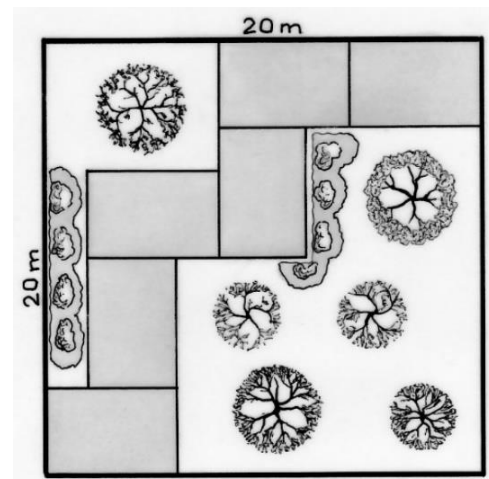
Exercise 12 7 pts

## EXOTIC GARDEN

Esteban creates an exotic garden in the shape of a square with a side of 20 m.

To allow his friends to admire it, he creates an alley by placing six identical rectangular slabs, one against the other, as in the drawing.

**Determine the area, in square meters, of the unpaved part of the exotic garden.**



Exercise 13 10 pts  
**THE SAILS OF MY MILL**

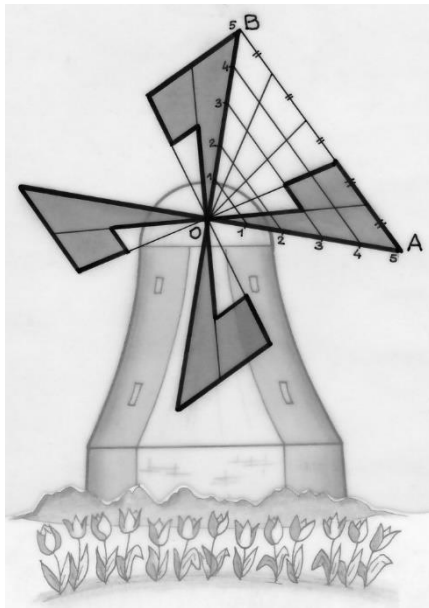
In this representation, the four gray shapes are the sails of a windmill.

The triangle OAB is an isosceles rectangle at O such that:  $OA = 5$  m.

Sides [OA] and [OB] were split into five segments of equal length.

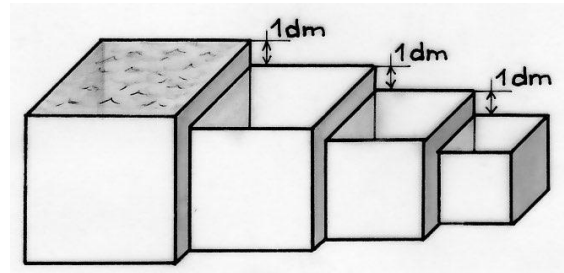
**Calculate the total area of the four sails.**

**Explain your reasoning.**



Exercise 13 10 pts  
**THE TANK IS FULL**

Here are four cubic tanks. Together, they don't contain a tonne of water.



The measurements of their edges, in decimeters, are four consecutive whole numbers.

It is possible to fill the three small tanks exactly with the contents of the large one.

**Give the measurement in decimeters of the edges of the four tanks and the volume in liters of each of these tanks.**

**Explain your reasoning.**

**The use of a spreadsheet for the resolution is recommended.**