# Junior Wiskunde Olympiade
Problems part 2

Thursday 23 September 2021
online

- The problems in part 2 are open questions. Write down your answer on the form at the indicated spot. Calculations or explanations are not necessary.
- Each correct and complete answer is awarded 3 points. For a wrong answer no points are deducted.
- You are allowed to use draft paper. The use of compass, ruler or set square is allowed. Calculators and comparable devices are not allowed.
- You have 45 minutes to solve these problems. **Good luck!**

1. In the rectangular cross on the right all sides have the same length. The vertices and midpoints of the sides are marked with dots. A straight line segment is called a *halving segment* if it passes through two of these dots, and it divides the cross into two parts of equal area.
How many halving segments does the cross have?
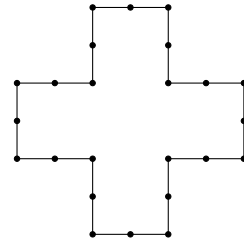
2. An artist has an extraordinary working rhythm. He works for 3 hours very intensively on his art, and then he sleeps for 8 hours before starting to work again. Suppose that he starts working at midnight in the night from 31 July to 1 August.
Which day of August is the first day after 1 August on which the artist is working the same number of hours as on 1 August?

3. On a school there are between 500 and 1000 students. The gymnastics teacher wants to divide the students into teams of eight persons each for a sports day. Three students are left over. If the teacher tries to divide the students into teams of nine students, again three students will be left over. Also with teams of ten students each, three students will be left over.
How many students attend the school?

4. Liselotte has a collection of 100 candies, which are either sweet or bitter. She wants to choose between the following possibilities.

I) She eats half of the sweet candies. The rest is kept in the bag.

II) She eats half of the bitter candies. The rest is kept in the bag.

The part of the remaining candies in case I that are bitter, is three times as large as the part of remaining candies in case II that are bitter.
How many bitter candies does the bag contain (before Liselotte eats any of them)?

PLEASE CONTINUE ON THE OTHER SIDE

5. A square with area 4 is divided into two grey and two transparent squares, each having an area of size 1; see the left figure. Another such square is put on top of this square. The side of the second square is lying exactly on the middle of the diagonal of the first square; see the right figure.
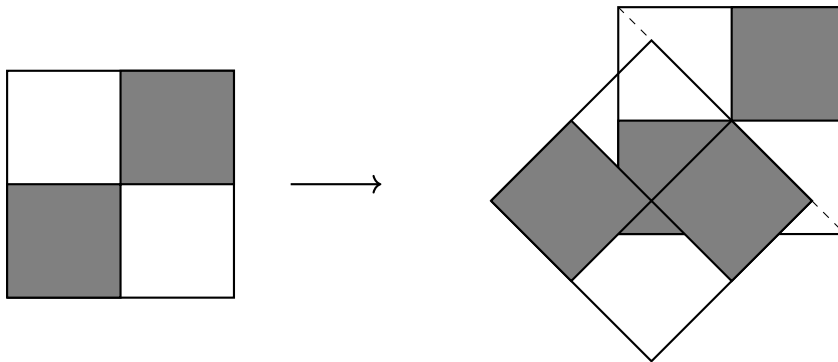
What is the area of the grey part in the right figure? Give your answer as a reduced fraction.

6. In a cafe, each product costs at most 12 ducats. Currently the cafe owner is only using coins worth one ducat. This is unpractical for the more expensive products, however. Therefore, the cafe owner has decided to introduce two types of coins next to the coins of one ducat. He is doing this in such a way that as many values from 1 to 12 ducats can be paid with at most two coins (without change).

What is the worth of the two new types of coins?

7. A four digit number $\overline{aabb}$, that is, the number whose digits are a, a, b, and b, is the square of an integer.

Of which integer is $\overline{aabb}$ the square?

8. We compute the product of two numbers,

$$99\ldots99 \times 99\ldots99,$$

where the first number consists of 20 nines, and the second of 21 nines.

Which number do you get if you add up the digits of the outcome of this multiplication?