Junior Wiskunde Olympiade
Problems part 1

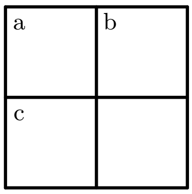
Saturday 29 September 2018
Vrije Universiteit Amsterdam

- The problems in part 1 are multiple choice questions. Exactly one of the five given options is correct. Please circle the letter of the correct answer on the form.
- A correct answer is awarded 2 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 finish these problems. **Good luck!**

1. When writing down the date 12 August 2018 using eight digits, each digit occurs exactly twice: 12-08-2018. There are more dates in 2018 having the same property. How many dates in 2018 have this property, including 12 August?

A) 5 B) 6 C) 7 D) 8 E) 9

2. In the crossword puzzle on the right, each square has to be filled with one of the digits 1 to 9. A digit may occur multiple times. For the 2-digit numbers formed in the rows and columns we are given the following four hints:



Across	**Down**
a. An odd number	a. A square
c. A square	b. An odd number

The puzzle has more than one solution, but the digit in the top-left corner is always the same. Which digit is in the top-left corner?

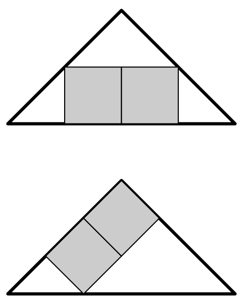
A) 1 B) 2 C) 3 D) 4 E) 6

3. Sophie likes to wear red and blue T-shirts. She decided to wear either a red or a blue T-shirt each day, starting from 1 January 2019. She does not want to say which colour she will be wearing on 1 and 2 January. From 3 January on, she will choose the colour of her T-shirt each day according to the following rule: she chooses red if she wore two different colours the last two days, and she chooses blue if she wore the same colour the last two days.

By following this rule, she will wear a blue T-shirt on her birthday, 14 January. Is it possible to determine with certainty the colours of the T-shirts she will be wearing on 28 and 29 January?

A) 28th: red, 29th: blue
B) 28th: blue 29th: blue
C) 28th: blue 29th: red
D) 28th: could be either 29th: blue
E) 28th: blue 29th: could be either

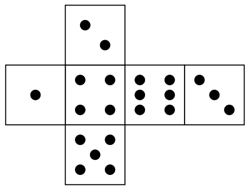
4. We have an isosceles triangle with two angles of 45 degrees; the long side has length 1. Within the triangle we put two squares of the same size. We can do this in two ways depicted in the two figures.
What is the total area of the two squares in the top figure minus the total area of the two squares in the bottom figure?



A) $\frac{1}{72}$ B) $\frac{1}{48}$ C) $\frac{1}{36}$ D) $\frac{1}{24}$ E) $\frac{1}{18}$

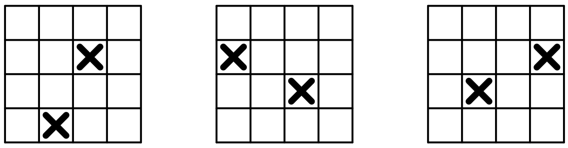
PLEASE CONTINUE ON THE OTHER SIDE

5. On a glass table, we arrange 100 dice tightly in a 10 by 10 square. This is done in such a way that if two dice are touching each other along a face, these faces have the same number of pips. Both the top and bottom faces of the 100 dice are visible. Altogether, on the front, rear, left, and right side there are 40 dice faces visible. We add the pips on all of these 240 visible faces.
What is the largest outcome that we can get?
In the figure on the right, you can see a net representing a dice.



A) 840 B) 880 C) 920 D) 1240 E) 1440

6. A large square is subdivided into 16 squares. We put crosses in two of these squares (see the figure). This can be done in different ways. Sometimes two such ways only differ by a rotation, for example the left two squares below. In this case, we consider the two ways as the same one and only count it once.

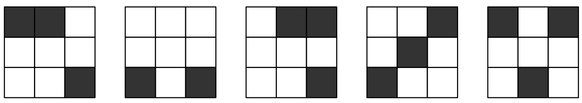


Pay attention: the right two squares are not considered to be the same. You could obtain the right square from the middle one by reflection, but not by using a rotation!

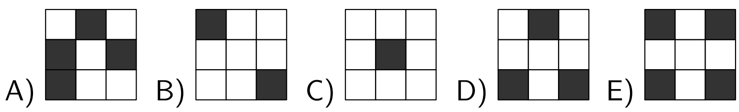
In how many different ways can you put the two crosses?

A) 21 B) 30 C) 32 D) 34 E) 36

7. Using 27 small cubes, of which some are black and the rest are white, we build a $3\times3\times3$ cube. This large cube has six views: a front, rear, left, right, top, and bottom view. In the figure, five of the views of the large cube are depicted.



Which could be the sixth view of the large cube?



A) B) C) D) E)

8. How many distinct pairs of digits a and b are there such that $5a68 \times 865b$ is divisible by 824?
Pay attention: we are counting pairs, so for example if for $a = 0$ the values $b = 0$, $b = 1$, and $b = 2$ are all valid, then these are counted as three different pairs.

A) 10 B) 11 C) 15 D) 19 E) 21