

# Junior Wiskunde Olympiade

## Problems part 1



Saturday 1 October 2016  
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 given.
- 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. The *sum of the digits* of a number is obtained by adding the digits of this number. For example, the sum of the digits of 76 equals  $7 + 6 = 13$ . The sum of the digits of the double of 76 is  $1 + 5 + 2 = 8$ .

How many numbers consisting of two digits are there for which the sum of the digits equals the sum of the digits of the double of the number?

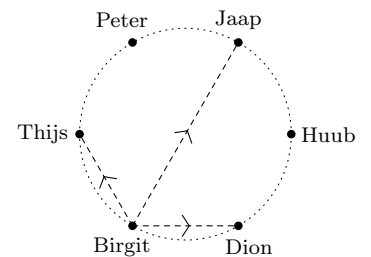
*Attention: the first digit cannot be a zero. Thus, the number 09, for example, is ruled out.*

- A) 0      B) 8      C) 9      D) 10      E) 11

2. Birgit, Dion, Huub, Jaap, Peter, and Thijs are standing in this order along a circle. They are playing a ball game, in which, at every turn, they pass the ball to a person directly next to them or exactly opposite to them. Initially, Birgit has the ball. After five passes, everybody has had the ball exactly once and the game ends.

Who can have the ball at the end of the game?

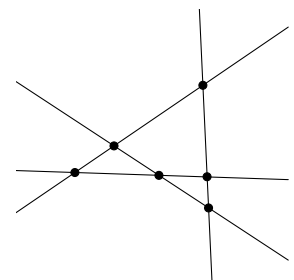
- A) Only Dion and Thijs                      D) Only Dion, Huub, Peter, and Thijs  
B) Only Dion, Jaap, and Thijs            E) Everybody except Birgit  
C) Only Huub, Jaap, and Peter



3. Four distinct straight lines are drawn on a (infinitely big) piece of paper. The number of points in which two or more lines intersect is counted. In the figure on the right, you see an example in which four lines intersect each other in 6 points. This number of intersection points does not always have to be 6.

What number of intersection points is *not* possible?

- A) 1      B) 2      C) 3      D) 4      E) 5



4. A baker's helper is filling cream puffs for one and a half hours. He is not in a hurry and he is filling two cream puffs every minute. At some point, the baker comes in and supervises the helper for a while. This motivates the helper to work a bit faster: during this time he is filling three cream puffs per minute. As soon as the baker has left, the helper reverts to filling the cream puffs at the initial, slow, pace. Afterwards, it turns out that during any continuous one hour period within these one and a half hours, the helper has filled exactly 140 cream puffs.

How many cream puffs are filled by the helper during the full one and a half hours?

- A) 180      B) 200      C) 210      D) 230      E) 270

5. Start with the number 60. Then, keep repeating the following two steps:

- (1) Throw a die and look at the number that comes up.
- (2) If your number is divisible by the number on the die, then you divide your number by the number on the die. If not, then you multiply your number by the number on the die.

In this way, you obtain a sequence of numbers. If your first three rolls are 5, 6, and 3, consecutively, then the first four numbers in your sequence are 60,  $60/5 = 12$ ,  $12/6 = 2$ , and  $2 \times 3 = 6$ . What is the greatest number you can obtain in this way?

- A) 60      B) 120      C) 240      D) 360      E) You can obtain arbitrarily large numbers

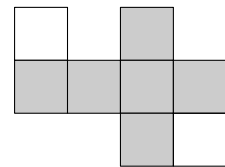
6. Harry and Hermione are trapped in a room in which 6 bottles are put next to each other. From left to right, the bottles are numbered 1 to 6. One of the bottles contains a potion that helps them to escape. On a piece of paper there are four clues to help them:

- 3 of the bottles contain poison, 2 of the bottles contain sleeping draught; the remaining bottle contains the potion to escape.
- Immediately left to the sleeping draught there is poison.
- The smallest bottle contains poison.
- The second bottle from the left and the second bottle from the right have the same content.

Hermione now has enough information to identify the bottle which contains the potion to escape. Which bottle is the smallest bottle?

- A) Bottle 1                      B) Bottle 2 or 5                      C) Bottle 3  
D) Bottle 4                      E) Bottle 6

7. A *net* of a cube is made by cutting a cube along some of the ribs until you can flatten it out (after cutting, you must still have one connected whole). By doing this in different ways, you can create different nets. The figure on the right consists of 8 squares. The 6 grey squares together form a net. In how many *other* ways can you choose 6 squares in the figure that together form a net?



- A) 3      B) 4      C) 5      D) 7      E) 9

8. Between the digits of the number 2016, we put one or more symbols from  $\times$ ,  $+$ , and  $-$  (you are allowed to use a symbol multiple times). In this way, we can create different numbers, such as  $20 + 1 \times 6$ , which is 26, and  $201 \times 6$ , which is 1206.

How many of the numbers from 1 to 10 are, just like 26 and 1026, the result of such a calculation? (Attention: you cannot put a  $-$  before the 2!)

- A) 6      B) 7      C) 8      D) 9      E) 10