Mathematics Competition for the Seventh Graders of Oulu sub-region, 20–24 February 2017

- The time allotted is 50 minutes.
- The allowed tools are writing and drawing instruments, i.e. pencil, eraser, ruler and compass. Calculators and mathematical tables are not allowed.
- Each problem has one correct answer. Wrong answers do not subtract points.
- The problems are not ordered by increasing difficulty, but the first problems are likely to be easier than the last ones.

1. Compute $538 - 489$.

a) -39 **b)** 59 **c)** 77 **d)** 25 **e)** 49

2. Compute $7 \cdot 6 - 6 \cdot 5 + 5 \cdot 4 - 4 \cdot 3 + 3 \cdot 2 - 2 \cdot 1$.

a) 16 **b)** 20 **c)** 24 **d)** 28 **e)** 32

3. Compute $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$.

a) 2350 **b)** 32925 **c)** 330510 **d)** 900000 **e)** 12000000

4. Let N be the area of a square. Let K be the area of a right triangle such that one of its legs has the same length as the side of the square and the other leg double the length of the side of the square. What can you say about the order of magnitude of the areas N and K?

a) $N = K$ **b)** $N > K$ **c)** $N < K$
d) The answer depends on the length of the side of the square.
e) The problem cannot be solved with the given information.

5. How many different ways can you choose positive integers x and y such that $\frac{1}{x} + \frac{1}{y} = 1$?

a) 0 **b)** 1 **c)** 4 **d)** 100 **e)** Infinitely many ways.

6. Five players participate in a chess tournament. Each plays exactly once against each other player. A player gets one point from a win, zero points from a loss and half a point from a tie. At the end of the tournament A has 3 points, B has $2,5$, C has $1,5$ and D has $0,5$ points. How many points does E have?

a) 2 **b)** 2,5 **c)** 3 **d)** 3,5 **e)** 4

7. A large box holds 50 kg of gummy bears. It takes $2\,\mathrm{m}^2$ of cardboard to make such a box (bottom, sides, top). How much cardboard does it take to make a box of identical shape which can hold 400 kg of gummy bears?

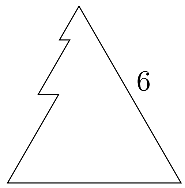
a) $4\,\mathrm{m}^2$ **b)** $6\,\mathrm{m}^2$ **c)** $8\,\mathrm{m}^2$ **d)** $16\,\mathrm{m}^2$ **e)** $20\,\mathrm{m}^2$

8.

Compute $2^{2017} - 2^{2016}$. Here 2^n denotes the product $2 \cdot 2 \cdot 2 \cdot \ldots \cdot 2$, where the number 2 appears n times.

a) 1 **b)** 2 **c)** $2^{\frac{2016}{2017}}$ **d)** 2^{2016} **e)** None of the options.

9. What is the perimeter of the figure below? All the angles in the figure are either $60°$ or $300°$.



a) 15 **b)** 16 **c)** 17 **d)** 18 **e)** 19

10. Define a new operation with the help of ordinary addition and multiplication: $a \oplus b = 3a - b$. For example $5 \oplus 6 = 3 \cdot 5 - 6 = 9$. Compute

$$(1 \oplus 1) + (2 \oplus 2) + (3 \oplus 3).$$

a) 10 **b)** 12 **c)** 14 **d)** 16 **e)** 18

11. Draw 10 lines on a plane. What is the largest possible number of intersection points in the picture?

a) 40 **b)** 45 **c)** 50 **d)** 55 **e)** 60

12. There are 21 kids in a kindergarten group. We know that five kids speak at least Finnish and English, six kids speak at least Finnish and Swedish and three kids speak at least Swedish and English. In addition we know that two kids speak Finnish, English and Swedish. How many kids speak exactly two languages (out of Finnish, English and Swedish)?

a) The problem cannot be solved with the given information.
b) None. **c)** 5 **d)** 8 **e)** 12

13. Let n be a positive odd integer. What is the largest positive integer which divides both $n + 7$ and $n^2 + 7n + 2$?

a) 1 **b)** 1 or 2, depending on n. **c)** 2 **d)** 1 or 3, depending on n. **e)** 3

14. The difference between two positive integers is ten. When the two integers are multiplied together, the product is one of the following five numbers. Which one?

a) 372 **b)** 375 **c)** 382 **d)** 383 **e)** 387

15. Glue 27 ordinary six-sided dice together to form a large $3 \times 3 \times 3$ cube. What is the smallest possible number you can get when you add together all the visible numbers in the large cube? In a die the sum of opposite sides is always 7.

a) 120 **b)** 135 **c)** 84 **d)** 101 **e)** 90