Mathematics Competition for the Seventh Graders of Satakunta, 2–6 March 2020

- The time allotted is 50 minutes.
- The allowed tools are writing and drawing instruments, i.e. pencil, paper, eraser, ruler and compass. Calculators and mathematical tables are not allowed.
- Each problem is worth of one point. Wrong answers are not punished.
- The problems are not ordered in increasing difficulty, but the first problems are likely to be easier than the last ones.

1. Compute $73.5 - 22.25$.

a) -149 **b)** 51.25 **c)** 512.5 **d)** 5125 **e)** 93.75

2. There are 68 apples in a basket. Some apples are added to the basket. After that, eight children divide the apples and each of them gets 12 apples. How many apples were added to the basket?

a) 0 **b)** 12 **c)** 20 **d)** 28 **e)** 68

3. Which of the following numbers is seventeen million five hundred thousand forty-nine?

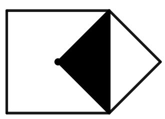
a) 1 750 049 **b)** 17 050 049 **c)** 17 500 049 **d)** 170 500 049 **e)** 175 000 049

4. How many different ways there are to arrange the letters of the word "HEY"? (The word obtained from the reordering does not have to mean anything.)

a) 2 **b)** 3 **c)** 4 **d)** 5 **e)** 6

5. Two squares intersect each other as shown in the figure, i.e. one of the vertices of the smaller square is in the center of the bigger square. The length of one side of the smaller square is 1. What is the area of the black region?

a) $\frac{1}{5}$ **b)** $\frac{1}{2}$ **c)** 1 **d)** 1.5
e) The answer depends on the the side length of the bigger square.



6. Maija and Miina plow the snow in the yard. If Maija plows the snow alone, it takes 2 hours. If Miina plows the snow alone, it takes 80 minutes. How much does it take when they plow the snow together?

a) 48 min **b)** 1 h **c)** 90 min **d)** 45 min **e)** 70 min

7. In a cuboid, there are exactly n sides of equal length. Which one of the following is a possible value for the number n?

a) 0 **b)** 4 **c)** 9 **d)** 11 **e)** All of the former

8. There is **more** than one column and **more** than one row of pieces of chocolate in a rectangular chocolate bar. The chocolate bar consists of n pieces of chocolate. Which one of the following is a possible value for the number n?

a) 2 **b)** 23 **c)** 59 **d)** 87 **e)** All of the former

9. In a school class, the average value of the mathematics grades was exactly 8.24. What is the minimum number of pupils in the class?

a) 32 **b)** 24 **c)** 30 **d)** 25 **e)** 20

10. Compute $\left|-\left(-\left(-\left(-\left(0-4\cdot 1\cdot 5\cdot \frac{1}{3}\cdot 3\cdot \frac{1}{4}\cdot \frac{1}{5}\right)\right)\right)\right)\right|$.

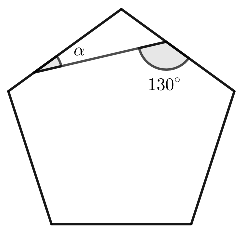
a) -1 **b)** 0 **c)** 1 **d)** $-\frac{4}{3}$ **e)** $\frac{4}{3}$

11. How many three-digit positive integers satisfy the following property: each digit in the number occurs as many times as its value is? For example, the number 122 satisfies the conditions since it contains one 1 and two 2's. Instead, the number 120 does not satisfy the conditions since, for example, the digit 2 does not occur twice.

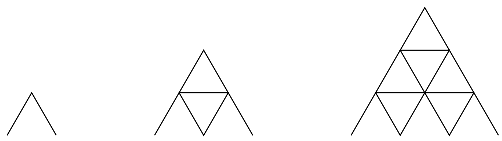
a) 1 **b)** 2 **c)** 3 **d)** 4 **e)** over 4

12. In the picture, there is a regular pentagon and one of its vertices is also one vertex of a triangle. Compute the value of the angle α (which is marked in the picture).

a) 3° **b)** 17° **c)** 22° **d)** 30° **e)** 65°



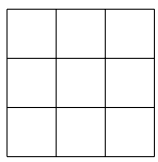
13. An equilateral triangular house of cards is built: the lowest floor consists of pairs of cards which lean against each other and thus form equilateral triangles. The next floors are built by adding a horizontal card on the top of the triangles and thus connecting two triangles. After that new triangles consisting of the cards are added on the top of the horizontal cards. How many cards are needed if the goal is to build a house of cards which has ten floors?



a) 155 **b)** 30 **c)** 145 **d)** 100 **e)** 175

14. The grid below is colored with green, red and blue in such a way that in each row and in each column each color occurs exactly once. How many different ways there are to do such a coloring?

a) 6 **b)** 12 **c)** 18 **d)** 24 **e)** 36



15. For a positive integer a, we define that $a!$ is the product of the numbers $1, 2, \ldots, a$. For example, $1! = 1$ and $5! = 1\cdot 2\cdot 3\cdot 4\cdot 5$. When a and b are positive integers, which one of the following can **not** be the last digit of the number $a! + b!$?

a) 6 **b)** 7 **c)** 8 **d)** 9 **e)** 0