White Level

1.(5 credits) Kostya and Seryozha are twins, and they have a brother: his name is Vitya and he is exactly 4 years younger than his brothers. On the anniversary of their birth, their mom baked a birthday cake and placed 35 candles on it (35 is the sum of the ages of all the boys). How old is Vitya? (Answer: 9)

Solution. Let Kostya and Seryozha's age be x, then Vitya's age is (x-4). The sum of ages of all boys is x+x+x-4=35. Then 3*x=39, x=13. The age of older boys is 13 and Vitya's age is 9.

2.(5 credits) The kindergarten attended by Kostya and Seryozha is guarded around the clock by six security guards. Two security guards patrol its territory at the same time. How many hours per week does each security guard work if their patrolling time is the same? (Answer: 56 hours)

Solution. There are 24*7=168 hours in a week; since two security guards patrol the territory at the same time, the total number of hours of their work time per week is 168*2=336. Thus, the duration of work time of each security guard is 336/6=56 hours in total.

3.(8 credits) Five girls, Inna, Kristina, Alisa, Oksana and Liza, who attend the kindergarten together with Kostya and Serezha, were born at the same year in one of the following days: September 12, July 15, January 24, May 7, June 12. Inna and Christina were born in the summer, Alisa has an odd-numbered birthday, and Oksana is three months younger than Inna. What day was Liza born on? (Answer: January 24)

Solution. Inna and Christina were born in the summer: on June 12 and July 15. Since Oksana is three months younger than Inna, Inna was born on June 12, Oksana was born on September 12, and Christina was born on July 15. There are two dates left: January 24 and May 7. Since Alice's birthday is odd-numbered, she was born on May 7th. Therefore, Liza was born on January 24.

4.(8 credits) Seryozha and Kostya help their grandma to pick apples. Seryozha picks 2 kg of apples per hour, and Kostya picks 3 kg. How much time will it take for them to pick 7 kg of apples if they work together? (Answer: 1.4 hours or 1 hour 24 minutes)

Solution. Both boys pick 5 kg of apples per hour together. Therefore they will pick 7 kg of apples in 7/5=1.4 hours.

5.(10 credits) Kostya and Seryozha decided to participate in a race. Vitya, who supported them at the start point, asked the brothers about their places. Seryozha said, 'The number of those who beat me is three times less than the number of runners beaten by me.' Kostya said, 'The number of those who beat me is six times less than the number of runners beaten by me; 2 runners came past me, and Seryozha finished after them.' How many runners participated in the race? (Answer: 29)

Solution. According to Seryozha's statement, the total number of runners was x+3*x+1 (x runners who beat him, plus 3*x runners beaten by him, plus Seryozha himself). According to Kostya's statement, the total number of runners was y+6*y+1. Since Seryozha finished after 2 runners who came past Kostya, y+3=x (number of runners who beat Kostya, plus Kostya himself, plus 2 runners who came between Seryozha and Kostya). Now, we have the following system of equations: 4*x=7*y and x=y+3. Therefore 4*y+12=7*y, 3*y=12, y=4, x=7. The total number of runners who participated in the race is 4*x+1=29.

6.(10 credits) Kostya and Seryozha weighed their toys. They put a dinosaur, a car and a pyramid on the scales, and Vitya dropped the pyramid from the scales, and the scales showed 500 grams. When the boys tried to weigh those items once more, Vitya dropped the car from the scales, and the scales showed 250 grams. When the toys were weighed for the third time, without a

dinosaur, the scales showed 350 grams. How much did all three toys weigh together? (Answer: 550 grams)

Solution. Let's assign the first letter of the name of each toy (namely: D, C, P) to the weight of this toy. Now, we have the following system of equations: D+C=500, D+P=250, C+P=350. After expressing all weights in terms of the weight D we get the following system of equations: C=500-D, P=250-D, C+P=500-D+250-D=750-2*D=350. Thus, 2*D=400, D=200, and therefore C=300, P=50. The total weight of the toys is 200+300+50=550 grams.

7.(12 credits) Seryozha put five 1×1 squares in a line. What is the minimum number of squares that should be attached to that line ('attached' means that every new square has at least one common side with the line of squares) to double the perimeter of the resulting figure in comparison with the perimeter of the original figure? (Answer: 6)

Solution. Since a minimum number of squares should be used, they should not touch each other to maximize the perimeter as effectively as possible. Each added square increases the perimeter of the figure by 2 units. The perimeter of the original figure is 12 units (1×5 rectangle), and it is necessary to add 6 squares to increase the perimeter by another 12 units.

8.(12 credits) Kostya and Seryozha's father jetted off on a business trip to Toronto. His aircraft left Moscow at 07.25PM and arrived to Toronto on the next day at 11:10AM (the time of departure and the time of arrival are local). When it was 2 o'clock in the morning in Moscow, it was 7 o'clock in the previous evening in Toronto. How long did the flight last? (Answer: 22 hours 45 minutes)

Solution. When it is 2 o'clock in the morning in Moscow, it is 7 o'clock in the previous evening in Toronto, and this means that Toronto time is 7 hours behind Moscow time, and that the aircraft left Moscow at 12.25PM Toronto time and arrived on the next day at 11:10AM Toronto time. Therefore, its travel time was 24 hours minus 1 hour 15 minutes, that is 22 hours 45 minutes.

9.(15 credits) Each face of a 4×4×4 cube is split into sixteen 1×1 squares. One square is painted black, and the rest are white (see fig.). Kostya paints black all squares having at least one common side with a black square in one turn. How many squares will be painted black after three Kostya's
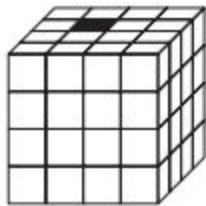
moves? (Answer: 25)

Solution. The painting procedure may be demonstrated on the cube's net:
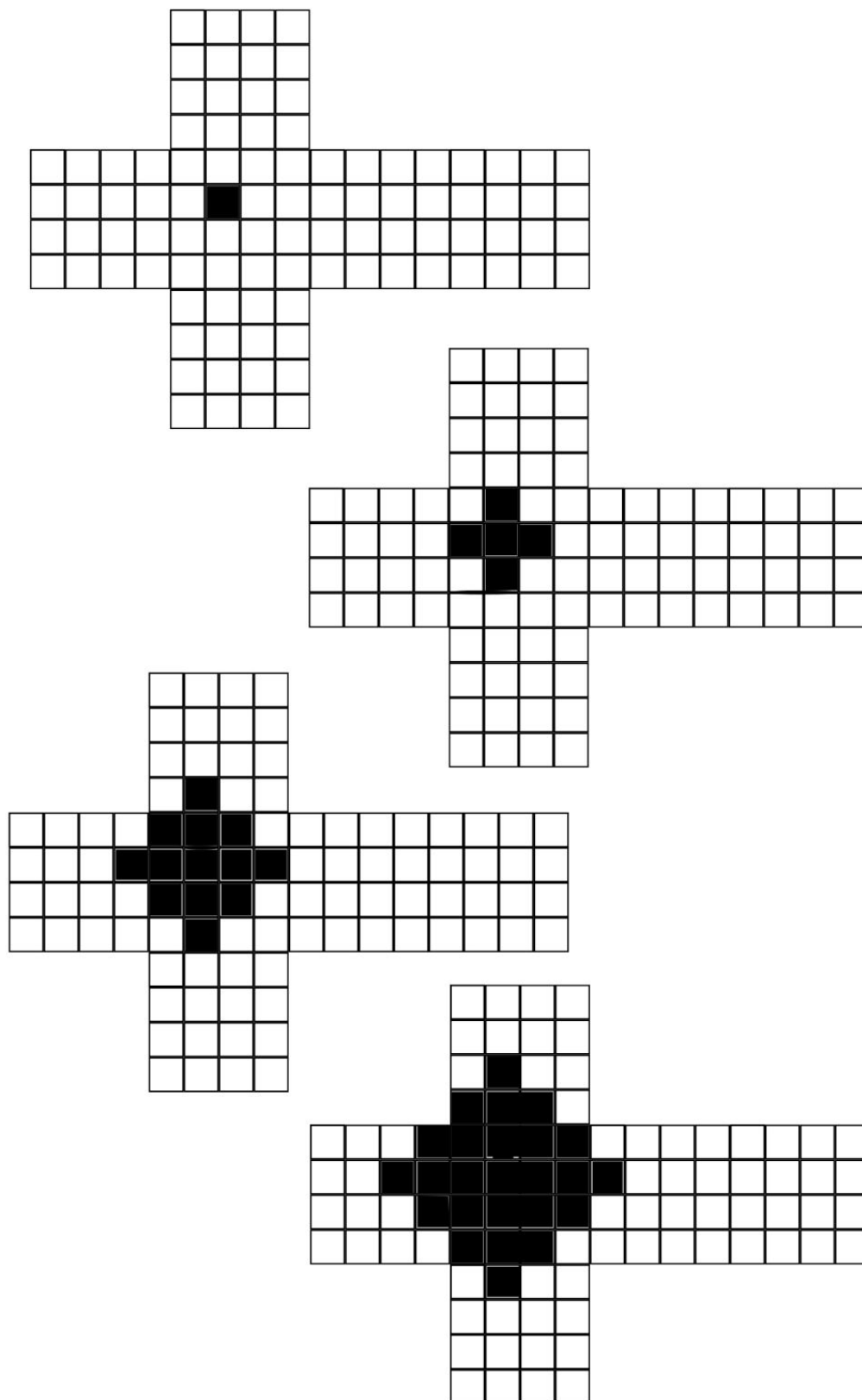
After three iterations, we have 25 cubes (see fig.).

10.   (15 credits) Playing in the after-school childcare club, Kostya and Seryozha threw their toy blocks (red, green and blue) around. The number of the red blocks is 5, the number of the green

blocks is three times more than the number of the red ones, and the number of the blue blocks is two times less than the total number of the red and green blocks. What is the minimum number of the blocks to be picked by the boys if they have to get at least one cube of each color? (Answer: 26)

Solution. The statement shows that the number of the red blocks is 5, the number of the green blocks is 3*5=15, and the number of the blue blocks is (5+15)/2=10. The 'worst' option is to pick all green and blue blocks and then to begin picking red blocks. Therefore, the minimum number of the blocks is 15+10+1=26.