Year 9 and 10 (ENGLISH VERSION)

Thursday, 15th March 2018 Time allowed: 75 minutes

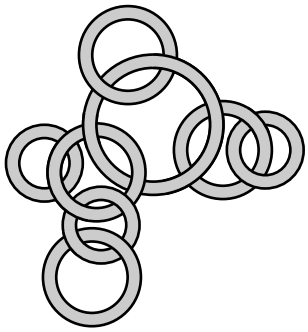
1. For each question exactly one of the 5 options is correct.
2. Each participant is given 30 points at the beginning. For each correct answer 3, 4 or 5 points are added. No answer means 0 points are added. If a wrong answer is given, one quarter of the points is subtracted, i. e. 0.75 points, 1 point or 1.25 points, respectively. At the end, the maximum number of points is 150, the minimum is 0.
3. Calculators and other electronic devices are not allowed.

3 point problems

A1 $\dfrac{2017+2018+2019}{2018} =$

(**A**) 2 (**B**) 6026 (**C**) $\dfrac{6025}{2018}$ (**D**) 3 (**E**) 6054

A2 How many rings are linked in the longest chain of rings in the diagram?

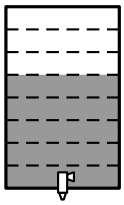
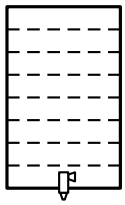
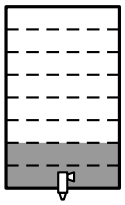
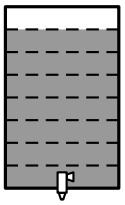
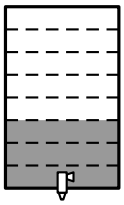


(**A**) 3 (**B**) 4 (**C**) 5 (**D**) 6 (**E**) 7

A3 In my family each child has at least two brothers and at least two sisters. What is the smallest possible number of children in my family?

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

A4 Before breakfast the five drink dispensers of the youth hostel (orange juice, hot chocolate, tea, apple juice and water) were full. During breakfast, twice as much hot chocolate as apple juice was drunk. The pictures show the filling levels after breakfast. Which drink dispenser contains apple juice?

(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

A5 In the 99-cent shop at the corner, each item costs indeed exactly 99 cents. What could be the total price for a larger number of items bought in this shop?

(**A**) 16.92 € (**B**) 36.90 € (**C**) 22.44 € (**D**) 15.51 € (**E**) 28.71 €

A6 Last summer we had the low pressure area "Alfred" with continual rain. On one day, it rained 78 litres per square meter according to the news. My small vegetable patch is 2 m long and 1.25 m wide. How many litres of rain fell on my vegetable patch that day?

(**A**) 156 litres (**B**) 178 litres (**C**) 195 litres (**D**) 234 litres (**E**) 246 litres

A7 Some of the digits in the calculation on the right have been replaced by the letters A, B, C and D, as shown. What is the value of $A+B+C+D$?

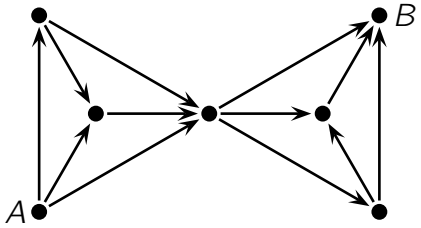
$$\begin{array}{r} A\ 4\ 5 \\ +\ B\ C\ D \\ \hline 6\ 5\ 4 \end{array}$$

(**A**) 14 (**B**) 15 (**C**) 16 (**D**) 17 (**E**) 24

A8 What is the sum of 25 % of 250 and 250 % of 25?

(**A**) 125 (**B**) 150 (**C**) 200 (**D**) 225 (**E**) 275

A9 How many different routes travelling only in the direction of the arrows are there from point A to point B?



(**A**) 20 (**B**) 16 (**C**) 12 (**D**) 9 (**E**) 6

A10 Class 9a plays basketball. Julian's team wins with 5 points ahead of Charlotte's team. Charlotte complains: "It's all because of Julian! If Julian's points counted for us, we would have won with 7 points ahead." How many points did Julian score?

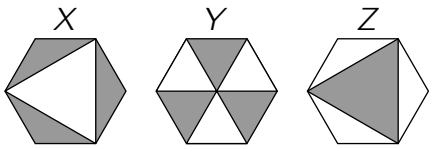
(**A**) 5 (**B**) 6 (**C**) 7 (**D**) 8 (**E**) 9

4 point problems

B1 A rectangular box with side lengths 42 cm, 60 cm and 90 cm is jam-packed with cubes, all of the same size. What is the maximum side length of such a cube?

(**A**) 3 cm (**B**) 4 cm (**C**) 6 cm (**D**) 7 cm (**E**) 12 cm

B2 The diagram on the right shows three congruent regular hexagons. The total areas of the shaded regions of the hexagons are X, Y and Z, as shown. Which of the following statements is true?

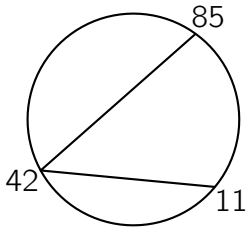


(**A**) $X = Y = Z$ (**B**) $Y = Z \neq X$ (**C**) $Z = X \neq Y$
(**D**) $X = Y \neq Z$ (**E**) $X \neq Y$, $Y \neq Z$, $Z \neq X$

B3 As part of a project, Emma, Linus, Natascha, Charlie and Defne counted how many text messages they had sent each other last week. There were 40 text messages in total. They counted that Emma, Linus, Natascha and Charlie each received or sent exactly 14 text messages. How many text messages did Defne receive or send?

(**A**) 12 (**B**) 18 (**C**) 20 (**D**) 24 (**E**) 28

B4 On the right, a regular polygon with 100 vertices is drawn. In the resolution shown, it cannot be distinguished from a circle. The vertices of this polygon are labelled clockwise from 1 to 100. By connecting the vertices 11 and 42 as well as 42 and 85, the polygon is divided into three new polygons. How many vertices does the new polygon with the largest number of vertices have?

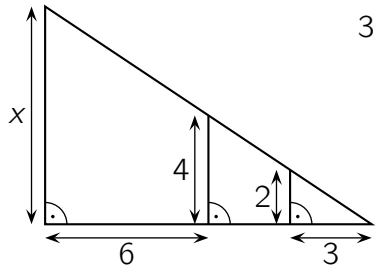


(**A**) 34 (**B**) 37 (**C**) 42 (**D**) 44 (**E**) 46

B5 The average age of the 4 children of the family next door is 12 and the average age of their parents is 36. How can the average age of all 6 persons in this family be calculated from these data?

(**A**) $\frac{12+36}{2}$ (**B**) $\frac{12}{4}+\frac{36}{2}$ (**C**) $\frac{12+36}{4+2}$ (**D**) $\frac{12\times4}{4}+\frac{36\times2}{2}$ (**E**) $\frac{4\times12+2\times36}{4+2}$

B6 What is x in the diagram on the right?



(**A**) 6 (**B**) 8 (**C**) 9 (**D**) 10 (**E**) 12

B7 Jolita's portable hard drive is full. A part of the hard drive is filled with videos. 65 % of the storage space for videos is filled with Jolita's favorite series. The remaining videos make up 7 % of the total storage space. What percentage of the hard drive is filled with Jolita's favorite series?

(**A**) 13 % (**B**) 15 % (**C**) 18 % (**D**) 21 % (**E**) 25 %

B8 How many times does the term 8^2 appear inside the square root in the equation

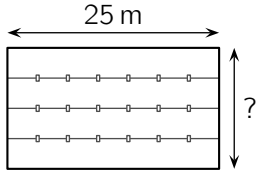
$$\sqrt{8^2 + 8^2 + \ldots + 8^2} = 8^4\,?$$

(**A**) 8^2 times (**B**) 8^3 times (**C**) 8^4 times (**D**) 8^6 times (**E**) 8^8 times

B9 Fynn, Josie and Rajk bought a book for their mother's birthday. Fynn spent half of what the other two spent together. Josie spent one third of what her two brothers spent together. Rajk spent 10 euros. What was the price of the book?

(**A**) 24 euros (**B**) 26 euros (**C**) 28 euros (**D**) 30 euros (**E**) 32 euros

B10 Jonathan and his little sister Mira decide to have a race. Mira runs around the perimeter of the swimming pool shown in the diagram while Jonathan swims lanes in the pool (*diagram not to scale*). Mira runs three times as fast as Jonathan swims. Jonathan swims six lanes in the pool in the same time as Mira runs around the pool five times. What is the width of the pool?



(**A**) 12 m (**B**) 15 m (**C**) 16 m (**D**) 18 m (**E**) 20 m

5 point problems

C1 Two buildings are located on one street at a distance of 250 metres from each other. There are 100 students living in the first building and 150 students living in the second building. Where should a bus stop be built so that the total distance that all students of both buildings have to walk from their buildings to this bus stop is as small as possible?

(**A**) in front of the first building
(**B**) in front of the second building
(**C**) 100 metres from the first building
(**D**) 100 metres from the second building
(**E**) halfway between the two buildings

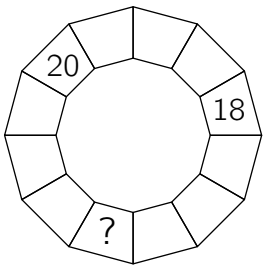
C2 Ioannis glued 125 small cubes of the same size together to make a big $5 \times 5 \times 5$ cube. Then, he painted some sides of this large cube completely red. Exactly 45 of the 125 small cubes have no painted side. How many sides of the big cube has Ioannis painted red?

(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

C3 Two circles with the same midpoint and radii 1 and 9 form a shape called an annulus. What is the largest possible number of non-overlapping circles that can be drawn such that each of these circles is tangent to both of the circles that form the annulus?

(**A**) 3 (**B**) 4 (**C**) 5 (**D**) 6 (**E**) 7

C4 In each cell of the ring in the picture a number should be written such that each number is equal to the sum of the numbers in the two adjacent cells. Two of the numbers are given. What number must be written in the cell with the question mark?



(**A**) 2 (**B**) -20 (**C**) 18 (**D**) 38 (**E**) -38

C5 Lina, Bao, Hans, Kim and Emre have made it to the final round of the annual school competition for languages. The following speculations circulated among the other students:

1. Either Lina or Bao will win.
2. Lina will not win.
3. Neither Bao nor Kim will win.
4. Emre will win.

Afterwards, it turned out that only one of these four speculations was true. Who won the competition?

(**A**) Lina (**B**) Bao (**C**) Hans (**D**) Kim (**E**) Emre

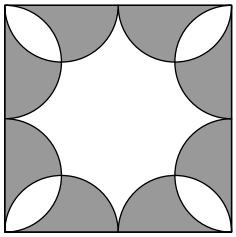
C6 The points $A_1, A_2, A_3, \ldots$ are marked on a straight line such that the segment $\overline{A_1A_2}$ has length 1 and each point A_n is the midpoint of the two immediately following points, i. e. A_{n+1} and A_{n+2}. What is the length of the segment $\overline{A_1A_{10}}$?

(**A**) 85 (**B**) 107 (**C**) 171 (**D**) 256 (**E**) 1023

C7 There are 5 little rabbits hidden in a magician's top hat: one black, one brownish, one pied, one grey and one white. With his eyes closed, the magician draws 2 rabbits out of the top hat. What is the probability that the white rabbit is among them?

(**A**) 25 % (**B**) 30 % (**C**) 40 % (**D**) 45 % (**E**) 50 %

C8 Eight congruent semicircles are drawn inside a square of side-length 4, as shown. What is the area of the shaded part of the square?

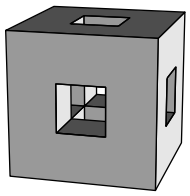


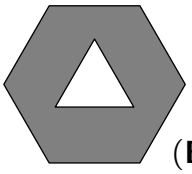
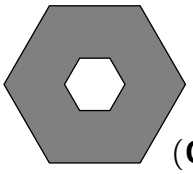
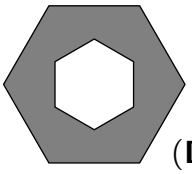
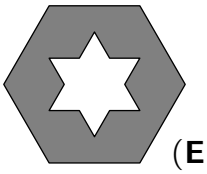
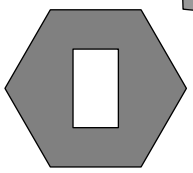
(**A**) 2π (**B**) 8 (**C**) $6+\pi$ (**D**) $3\pi-2$ (**E**) 3π

C9 Abdul wrote down four positive numbers. He chose one of them and added it to the average of the other three. He repeated this for each of the four numbers in turn. The four results were 17, 21, 23 and 29. What is the largest of Abdul's numbers?

(**A**) 12 (**B**) 15 (**C**) 21 (**D**) 23 (**E**) 24

C10 Seven small cubes have been deleted from a large $3 \times 3 \times 3$ cube, as shown in the diagram. We intersect this cube with a plane passing through the centre of the large cube and perpendicular to one of its four space diagonals. What does the cross-section look like?



(**A**)  (**B**)  (**C**)  (**D**)  (**E**)