Year 9 and 10 (ENGLISH VERSION)

Thursday, 16th March 2023　　　　　　　　　　　　　　　　　　　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 $(33 + 3333 + 333333) - (3 + 333 + 33333) =$

(**A**) 393939　　　(**B**) 303030　　　(**C**) 360360　　　(**D**) 369369　　　(**E**) 330330

A2 In which of the following pictures is there more than one string?

(**A**)　　　　　(**B**)　　　　　(**C**)　　　　　(**D**)　　　　　(**E**)
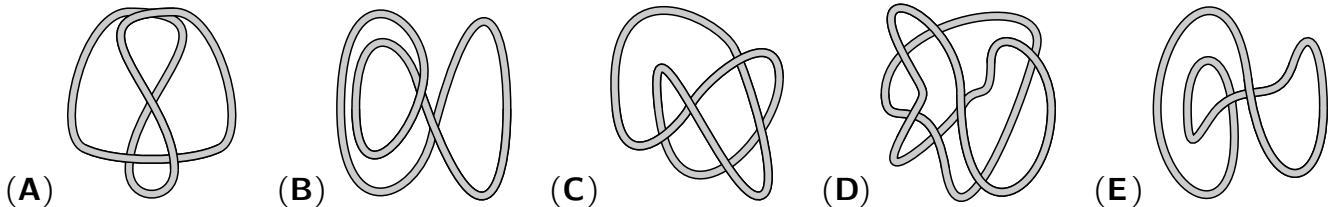
A3 To prevent Fiete from getting sunburned, he should spend no more than 5 minutes in the sun without sunscreen. With a sunscreen with sun protection factor 40, he can supposedly stay in the sun 40 times as long. How long would that be?

(**A**) 2 hours and 30 minutes　　　(**B**) 2 hours and 50 minutes　　　(**C**) 3 hours and 20 minutes
(**D**) 3 hours and 40 minutes　　　(**E**) 4 hours and 15 minutes

A4 This morning Marie-Luise was in a hurry. She even had to run so as not to miss her underground. Two stops later she got off and walked to school as usual. One of the following speed-time diagrams fits Marie-Luise's way to school. Which one?

(**A**)　　　　　(**B**)　　　　　(**C**)　　　　　(**D**)　　　　　(**E**)
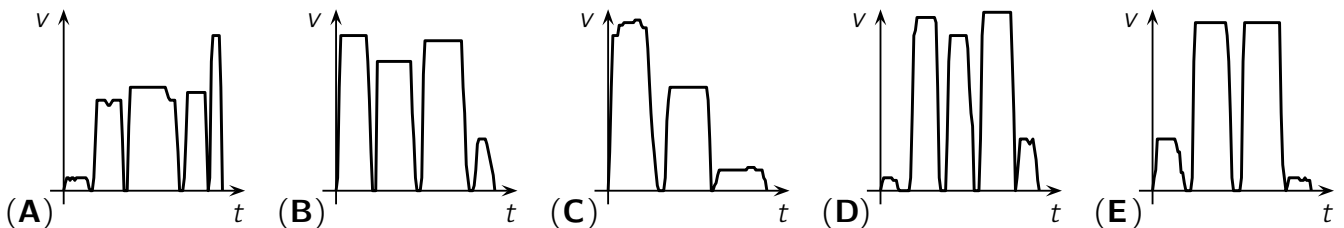
A5 On the right is a large square with side length 10 cm and a small square with side length 4 cm. The small square is exactly in the middle of the large square. What is the area of the grey part?
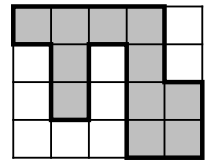

(**A**) 25 cm^2　　　(**B**) 30 cm^2　　　(**C**) 40 cm^2　　　(**D**) 42 cm^2　　　(**E**) 45 cm^2
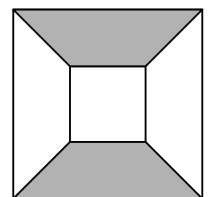
A6 In 2023 days, it will be the same day of the week as

(**A**) the day before yesterday.　　　(**B**) yesterday.　　　(**C**) today.
(**D**) tomorrow.　　　(**E**) the day after tomorrow.

A7 The rectangle shown is composed of 20 squares of equal size. The perimeter of the grey part is 66 cm long. What is the area of the rectangle?

(**A**) 162 cm²   (**B**) 180 cm²   (**C**) 198 cm²   (**D**) 215 cm²   (**E**) 240 cm²

A8 Biologists caught 50 frogs from a pond, tagged them and then released them. A short time later, they caught 100 frogs from the same pond. Of these, 5 were already tagged. Which of the following numbers is a reasonable estimate for the number of frogs in this pond?

(**A**) 250   (**B**) 500   (**C**) 1000   (**D**) 1750   (**E**) 2500

A9 The natural numbers m and n are both odd. Which of the following numbers is then also odd?

(**A**) $m \times (n+1)$ (**B**) $(m-n)^2$ (**C**) $m+2n+3$ (**D**) $m+n$ (**E**) $m \times n + 2$

A10 In the school library, a new shelf is built on one wall. There are always 7 horizontal boards between neighbouring vertical boards. The total number of boards is one of the following numbers. Which one?
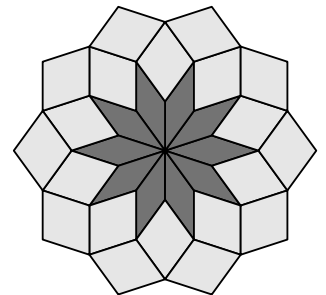
(**A**) 65   (**B**) 66   (**C**) 67   (**D**) 68   (**E**) 69

4 point problems

B1 How many pairs (a, b) of natural numbers satisfy the equation $\dfrac{a}{5} = \dfrac{7}{b}$?

(**A**) 1   (**B**) 2   (**C**) 4   (**D**) 6   (**E**) 8

B2 A mosaic was created from 30 rhombuses. The 20 light rhombuses are all congruent to each other, and the 10 dark ones are all congruent to each other. What is the larger interior angle of the light rhombuses?

(**A**) 106°   (**B**) 108°   (**C**) 110°   (**D**) 112°   (**E**) 114°

B3 There are exactly 200 employees in my mother's company. Of these, 49 % are female. There are also some trainees, who are all female. If you count all the employees and trainees together, 50 % of them are female. How many trainees are there in this company?

(**A**) 4   (**B**) 8   (**C**) 10   (**D**) 16   (**E**) 20

B4 Maliyah's little sister has stacked 90 building blocks to form a tower. The numbers from 1 to 90 are written on the building blocks from bottom to top. Now Maliyah takes away three building blocks at a time from the top and stacks them to form a new tower. How many building blocks are there in the new tower between the building block with the 39 and the building block with the 40?
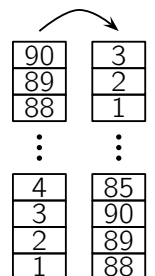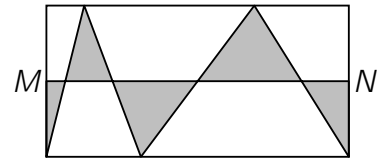
(**A**) 0   (**B**) 1   (**C**) 2   (**D**) 3   (**E**) 4

B5 What is the smallest natural number that is the average (arithmetic mean) of four different prime numbers?

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

B6 The two points M and N are the midpoints of the left and right sides of the rectangle shown. What fraction of the area of the rectangle is coloured grey?

(**A**) $\frac{1}{7}$ (**B**) $\frac{1}{6}$ (**C**) $\frac{1}{5}$ (**D**) $\frac{1}{4}$ (**E**) $\frac{1}{3}$

B7 Nick tries to save water. To do so, he has shortened the duration of his morning shower by one quarter. In addition, he now uses a water-saving shower head that uses one quarter less water. By how much has Nick reduced his water consumption when showering?

(**A**) by $\frac{1}{3}$ (**B**) by $\frac{3}{8}$ (**C**) by $\frac{5}{8}$ (**D**) by $\frac{5}{12}$ (**E**) by $\frac{7}{16}$

B8 In our high-rise building the staircase was renovated. There are 272 steps in total and every 6th step from the bottom had to be repaired. After that, a special marking for the visually impaired was placed on every 8th step from the bottom at the edge of the steps. On how many of the repaired steps was a marking applied?

(**A**) 9   (**B**) 11   (**C**) 17   (**D**) 20   (**E**) 25

B9 The three squares in the picture have side lengths 6 cm, 10 cm and 16 cm. What is the area of the grey trapezium?

(**A**) 55 cm^2 (**B**) 60 cm^2 (**C**) 65 cm^2 (**D**) 70 cm^2 (**E**) 75 cm^2
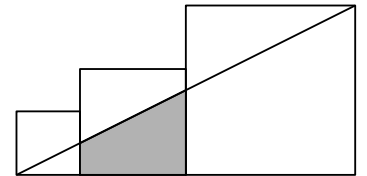
B10 A 76 cm long wire was cut into three pieces. The 2nd piece is 50 % longer than the 1st piece, and the 3rd piece is 50 % longer than the 2nd piece. How long is the 3rd piece?

(**A**) 26 cm   (**B**) 27 cm   (**C**) 31 cm   (**D**) 33 cm   (**E**) 36 cm

5 point problems

C1 The pentagon $ABCDE$ has been divided into six isosceles triangles, which all have the same perimeter. The triangle ABC is even equilateral. What is the ratio of the perimeter of the triangle ABC to the perimeter of the pentagon $ABCDE$?

(**A**) 1 : 3   (**B**) 4 : 9   (**C**) 3 : 7   (**D**) 9 : 16   (**E**) 5 : 8
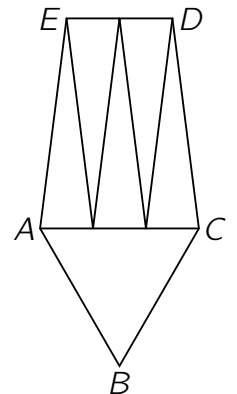
C2 Jana has thought up a sequence of numbers. She starts with the four numbers 2, 0, 2, 3. As the next number she always takes the smallest non-negative integer that is different from the four previous numbers. What is the 2023rd number in this sequence of numbers?
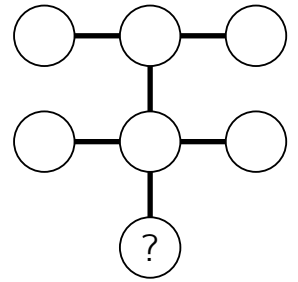
(**A**) 0   (**B**) 1   (**C**) 2   (**D**) 3   (**E**) 4

C3 Feodor has drawn a closed line on a cuboid. What does the net of this cuboid definitely <u>not</u> look like?

(**A**)   (**B**)   (**C**)   (**D**)   (**E**)
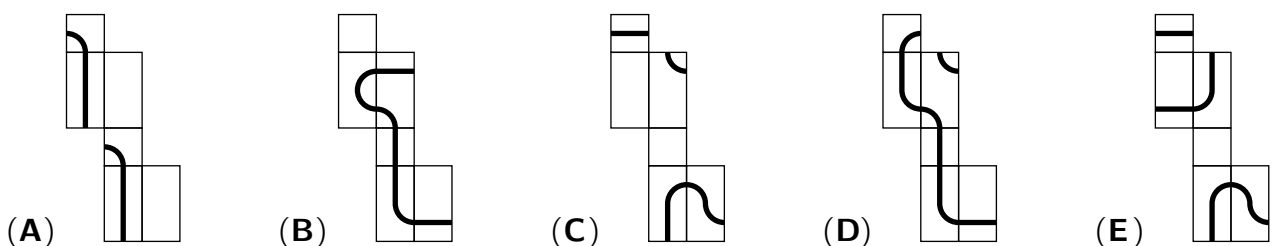
C4 Seven different one-digit natural numbers are to be written in the circles. The product of the three numbers on each of the three lines should be the same. Which number must be written in the circle with the question mark?

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

C5 A rectangle with the vertices $(0 \mid 0)$, $(100 \mid 0)$, $(100 \mid 50)$ and $(0 \mid 50)$ has been drawn into a coordinate system. Now a straight line is to be drawn through the point $(75 \mid 30)$, which divides the rectangle into two equal parts. What is the slope of this straight line?

(**A**) $\dfrac{1}{5}$ (**B**) $\dfrac{2}{3}$ (**C**) $\dfrac{2}{5}$ (**D**) $\dfrac{1}{2}$ (**E**) $\dfrac{1}{3}$

C6 When Metin's smartphone is fully charged, he can use it to make phone calls for 16 hours or surf the internet for 10 hours. The battery lasts 40 hours when Metin is not using his smartphone. When Metin got on the train in the morning, the battery was exactly half charged. He spent one third of the journey making phone calls, another third surfing the internet, and the rest of the time he did not use his smartphone. Just as Metin gets off the train, his smartphone goes off because the battery is empty. How long was the train journey?

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

C7 The numbers that are written in the regions of the figure on the right indicate the circumference of the respective region in cm (*figure not to scale*). What is the length of the outer boundary line of the figure?

(**A**) 22 cm   (**B**) 26 cm   (**C**) 28 cm   (**D**) 32 cm   (**E**) 34 cm
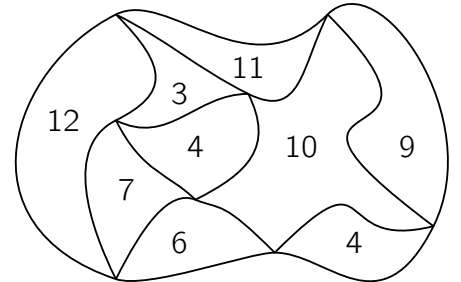
C8 There are 3-digit natural numbers N with the following property: The difference between N and the sum of the digits of N is a 3-digit number with 3 equal digits. How many such numbers N are there?

(**A**) 10   (**B**) 12   (**C**) 20   (**D**) 27   (**E**) 39

C9 The two semicircles in the figure both have the radius 1 cm and touch each other and the mutually parallel straight lines AB and CD. What is the square of the length of the segment $\overline{AD}$ in cm^2 ?

(**A**) $10 + 3\sqrt{3}$ (**B**) $6 + 6\sqrt{2}$ (**C**) $9 + 5\sqrt{2}$
(**D**) $11 + 2\sqrt{3}$ (**E**) $8 + 4\sqrt{3}$
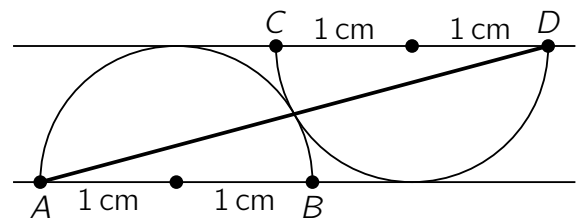
C10 The numbers from 1 to 6 are to be written into the boxes so that the sum of the numbers in three neighbouring boxes is a multiple of 3 everywhere. How many different possibilities are there for this?

(**A**) 48   (**B**) 64   (**C**) 72   (**D**) 81   (**E**) 120