Year 7 and 8 (ENGLISH VERSION)

Thursday, 16th March 2023 Time allowed: 75 minutes

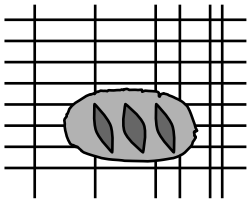
1. For each question exactly one of the 5 options is correct.
2. Each participant is given 30 points at the beginning. For each correct answer 3, 4 or 5 points are added. No answer means 0 points are added. If a wrong answer is given, one quarter of the points is subtracted, i. e. 0.75 points, 1 point 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.

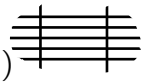
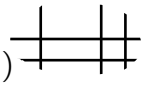
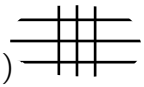
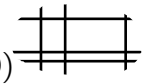
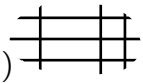
3 point problems

A1 $2023 \div (2 + 0 + 2 + 3) =$

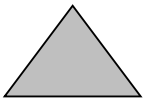
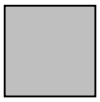
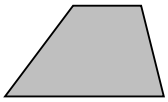
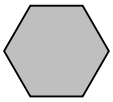
(**A**) 179 (**B**) 198 (**C**) 269 (**D**) 289 (**E**) 301

A2 A freshly baked loaf of bread has been placed on a grate to cool down. What does the part of the grate under the bread look like?

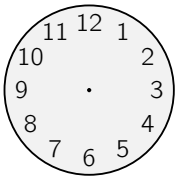


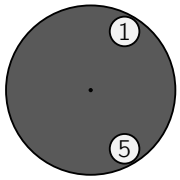
(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

A3 Which of the following figures (triangle, square, trapezium, regular hexagon, rectangle) cannot be divided into two trapezia with one straight line?

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

A4 The dark circular disc with the two holes fits exactly on the clock face. Now the dark disc is rotated around the common centre so that a 10 can be seen in one of the holes. Which number can then be seen in the other hole?



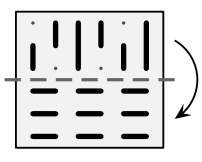


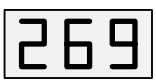
(**A**) 2 or 7 (**B**) 2 or 6 (**C**) 1 or 8 (**D**) 3 or 6 (**E**) 3 or 7

A5 Marvin turns 10 000 days old today. How old is he?

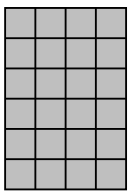
(**A**) between 0 and 3 years (**B**) between 4 and 12 years (**C**) between 13 and 19 years
(**D**) between 20 and 49 years (**E**) between 50 and 99 years

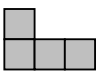
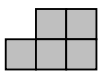
A6 Kristina has a transparent piece of foil with some lines drawn on it. She folds it down along the dashed line. What can be seen now?



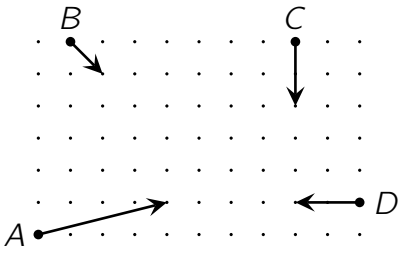
(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

A7 The rectangle shown should be made of identical figures. The figures may be rotated and there must be no gaps or overlaps. With which of the five figures is this not possible?



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

A8 The illustration shows 4 bumper cars, their starting position, their direction of travel and how far they move in 5 seconds (using arrows). Which two cars will collide?

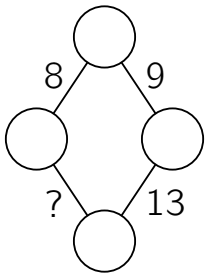


(**A**) *A* and *C* (**B**) *C* and *D* (**C**) *A* and *B*
(**D**) *B* and *C* (**E**) *A* and *D*

A9 There are currently 40 learner drivers registered at the "Blitz" driving school. Of these, 40 % have already passed the theory test and 60 % have not yet passed. How many of the learner drivers still have to pass the theory test so that exactly half of the 40 learner drivers have passed?

(**A**) 2 (**B**) 4 (**C**) 6 (**D**) 7 (**E**) 9

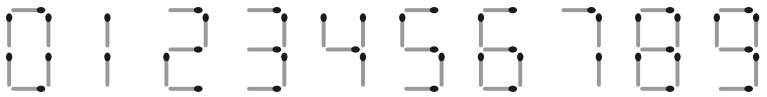
A10 A number is to be written in each circle of the figure shown. Between two neighbouring circles there is always the sum of the numbers in these two circles. Which number must be written in the place of the question mark?



(**A**) 12 (**B**) 13 (**C**) 14 (**D**) 15 (**E**) 16

4 point problems

B1 Matches can be used to lay the digits from 0 to 9:



How many different natural numbers can be laid with exactly five matches?

(**A**) 2 (**B**) 5 (**C**) 7 (**D**) 8 (**E**) 11

B2 Evita wants to write the numbers from 1 to 8 in the boxes of the grid shown so that the sums of the numbers in the boxes in the four rows are equal and the sums of the numbers in the boxes in the two columns are equal. She has already written the numbers 3, 4 and 8. Which number must she write in the grey box?

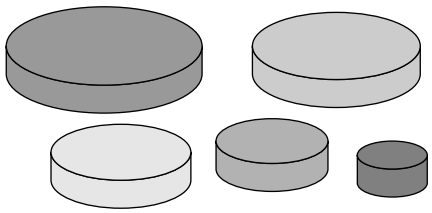
	3
4	
	8

(**A**) 1 (**B**) 2 (**C**) 5 (**D**) 6 (**E**) 7

B3 Laurenz writes down three consecutive three-digit numbers in order of size. He starts with the smallest number. Instead of digits, he uses symbols: □◊◊, ♡△△, ♡△□. Which number is next?

(**A**) ♡♡◊ (**B**) □♡□ (**C**) ♡△◊ (**D**) ♡◊□ (**E**) ♡△♡

B4 Marlene wants to build a tower with three of the discs shown. The discs should get smaller and smaller from the bottom to the top. How many different towers can Marlene build?

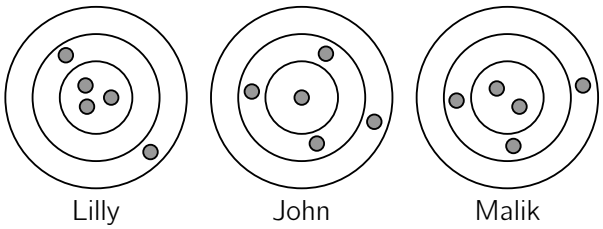


(**A**) 6 (**B**) 8 (**C**) 10 (**D**) 12 (**E**) 15

B5 Beavers and kangaroos have lined up in a circle. There are 18 animals in total. Next to each kangaroo is at least one beaver. What is the largest possible number of kangaroos in this circle?

(**A**) 11 (**B**) 12 (**C**) 13 (**D**) 14 (**E**) 15

B6 Lilly, John and Malik each throw five arrows at a target. Arrows that land in the same ring give the same score. Lilly has scored 46 points and John 34 points. How many points did Malik score?

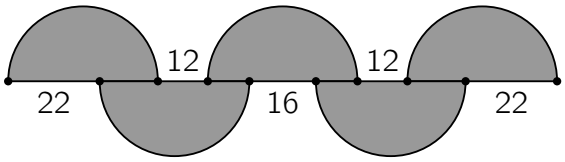


(**A**) 37 (**B**) 38 (**C**) 39 (**D**) 40 (**E**) 41

B7 What is the smallest number of edges of a cube that must be coloured red so that each face of the cube has at least one red edge?

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

B8 The drawing shows five semicircles of the same size. The lengths of some of the distances are given in cm. What is the radius of the semicircles?



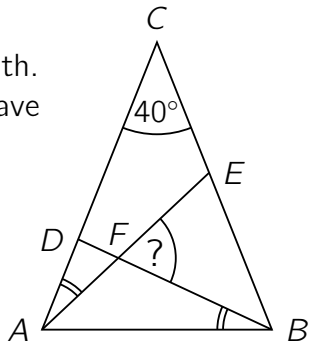
(**A**) 14 cm (**B**) 15 cm (**C**) 17 cm (**D**) 18 cm (**E**) 20 cm

B9 In the expression shown on the right, the square and the triangle are to be replaced by natural numbers so that both fractions have the same value. How many different numbers can replace the square?

$$\frac{\square}{17} = \frac{5}{\triangle}$$

(**A**) 3 (**B**) 4 (**C**) 6 (**D**) 8 (**E**) 9

B10 The triangle ABC is isosceles, the sides $\overline{AC}$ and $\overline{BC}$ have the same length. The size of the angle ACB is 40°. The two marked angles EAC and DBA have the same size. What is the size of the angle BFE?



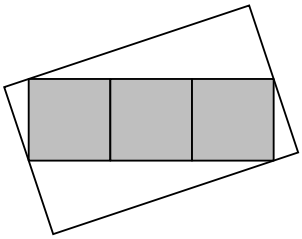
(**A**) 55° (**B**) 60° (**C**) 65° (**D**) 70° (**E**) 75°

5 point problems

C1 Louis is standing bored in a queue. He notices that the number of people in the queue is a multiple of 3 and that there are as many people in front of him as behind him. He sees two friends who are both behind him in the queue, one in the 19th place and the other in the 28th place in the queue. Where is Louis standing in the queue?

(**A**) in the 14th place (**B**) in the 15th place (**C**) in the 16th place
(**D**) in the 17th place (**E**) in the 18th place

C2 The three grey squares in the picture each have an area of 16 cm^2. They form a rectangle whose corners lie on the sides of the large rectangle. Two vertices of the grey rectangle coincide with the midpoints of the shorter sides of the large rectangle. What is the area of the large rectangle?



(**A**) 76 cm^2 (**B**) 84 cm^2 (**C**) 86 cm^2 (**D**) 92 cm^2 (**E**) 96 cm^2

C3 The seven dwarfs played chess today. Dopey, the smallest dwarf, reports to Snow White, "Grumpy only played against one dwarf, Sleepy against two, Sneezy against three, Bashful against four, Happy against five and Doc against six." "Then I know how many dwarfs you played against," says Snow White. Against how many dwarfs did Dopey play?

(**A**) two (**B**) three (**C**) four (**D**) five (**E**) six

C4 The square $ABCD$ has side length 1 cm. How many distinct points are there in the plane that are each 1 cm away from two of the vertices A, B, C, D?

(**A**) 6 (**B**) 10 (**C**) 12 (**D**) 16 (**E**) 20

C5 Finja has written the number 1015 as a sum of numbers. The summands contain only the digit 7, a total of 10 times. Now Finja wants to write the number 2023 as a sum of numbers. Again, the summands should only contain the digit 7, this time a total of 19 times. How often must Finja use the number 77 as a summand?

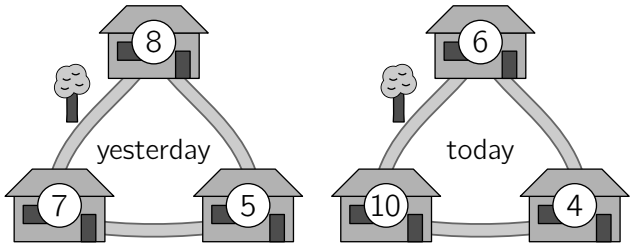
(**A**) 2 times (**B**) 3 times (**C**) 4 times (**D**) 5 times (**E**) 6 times

$$\begin{array}{rr} & 777 \\ + & 77 \\ + & 77 \\ + & 77 \\ + & 7 \\ \hline & 1015 \end{array}$$

C6 At the start of training, Elisabeth runs 3 laps around the sports field. She runs the first lap at a constant speed of 8 km/h, the second lap at a constant speed of 10 km/h, and the third lap at a constant speed of 15 km/h. What is Elisabeth's average speed for these 3 laps?

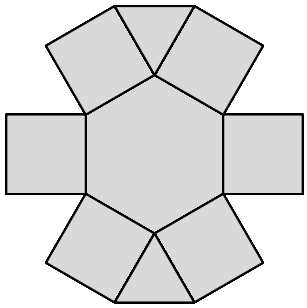
(**A**) $\frac{72}{7}$ km/h (**B**) $\frac{59}{6}$ km/h (**C**) $\frac{53}{5}$ km/h (**D**) $\frac{41}{4}$ km/h (**E**) $\frac{29}{3}$ km/h

C7 A total of 20 mice live in three neighbouring houses. Last night, each mouse left its house and moved directly to one of the other two houses. The numbers in the drawing indicate the number of mice per house yesterday and today. How many mice took the path along the tree?



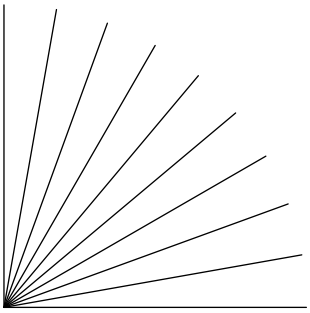
(**A**) 8 (**B**) 9 (**C**) 11 (**D**) 12 (**E**) 14

C8 The figure on the right consists of 9 cells that are triangular, square and hexagonal. Konstantin wants to write the numbers from 1 to 9 in the cells. The product of the numbers in two cells that have a common side should not be greater than 15. In how many different ways can he do this?



(**A**) 8 (**B**) 12 (**C**) 16 (**D**) 24 (**E**) 32

C9 Alina has drawn 10 rays with a pencil. Adjacent rays enclose an angle of size 10°. What is the largest number of rays she can erase so that for each of the values 10°, 20°, 30°, 40°, 50°, 60°, 70°, 80° and 90° she can still find two rays that enclose an angle of this size?



(**A**) 6 (**B**) 5 (**C**) 4 (**D**) 3 (**E**) 2

C10 Last season, a handball team scored 33 goals in the 7th game, 27 goals in the 8th game and 29 goals in the 9th game. On average, the team scored more goals after 9 games than after the first 6 games. After the 10th game, the average number of goals per game was greater than 30. What is the smallest possible number of goals that the team scored in the 10th game?

(**A**) 32 (**B**) 33 (**C**) 34 (**D**) 35 (**E**) 36