

Year 11 to 13 (ENGLISH VERSION)

Thursday, 19th March 2020

Time allowed: 75 minutes

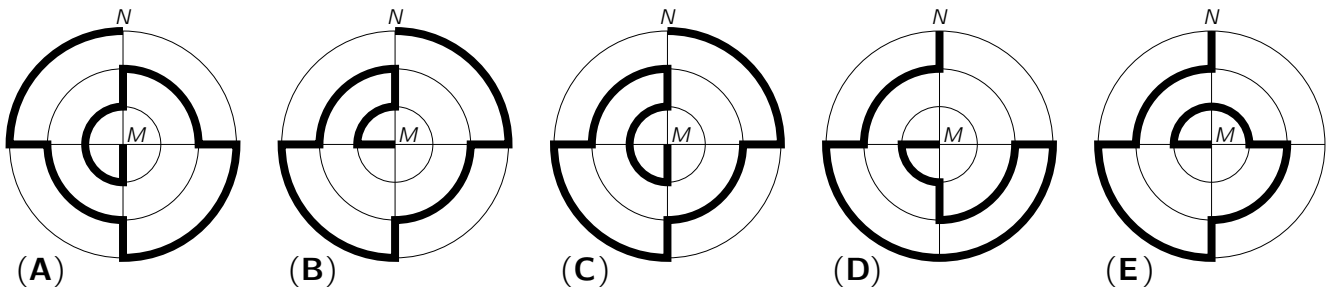
1. For each question exactly one of the 5 options is correct.
2. Each participant is given 30 points at the beginning. For each correct answer 3, 4 or 5 points are added. No answer means 0 points are added. If a wrong answer is given, one quarter of the points is subtracted, i. e. 0.75 points, 1 point 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 $\frac{10^2 + 20^2 + 30^2}{20} =$

- (A) 20 (B) 30 (C) 40 (D) 60 (E) 70

A2 The following paths from *N* to *M* run along the three circles with centre *M* and the two diameters perpendicular to each other. Which of these paths is the shortest?

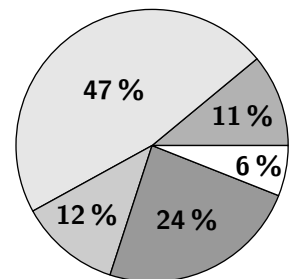


A3 For breakfast, Frieda is making French toast today. For this, the slices of toast are fried in the pan for exactly 4 minutes on each side. But only 2 slices fit into Frieda's pan at the same time. How much time does she need at least to make 3 slices of French Toast?

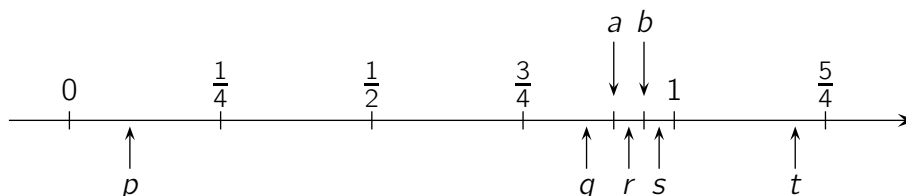
- (A) 8 minutes (B) 10 minutes (C) 12 minutes (D) 14 minutes (E) 18 minutes

A4 The pie chart on the right shows how the students in my class get to school. About twice as many come to school by bicycle as by bus. About the same number come to school on foot as are taken by car. The rest come by moped. What is the percentage of students who come to school by moped?

- (A) 6% (B) 11% (C) 12% (D) 24% (E) 47%



A5 Two numbers *a* and *b* are marked on the number line:



One of the numbers *p*, *q*, *r*, *s*, *t* is the product $a \times b$. Which one?

- (A) *p* (B) *q* (C) *r* (D) *s* (E) *t*

A6 Two (fair) dice are thrown simultaneously. The dice have two red, two blue and two white sides each. What is the probability that both dice show the same colour?

- (A) $\frac{4}{9}$ (B) $\frac{1}{12}$ (C) $\frac{1}{6}$ (D) $\frac{2}{9}$ (E) $\frac{1}{3}$

A7 How many different real numbers x satisfy the equation $\frac{x^2}{3} = \frac{3}{x^2}$?

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

A8 In the addition on the right, the same letters stand for the same digits. What is the value of $A + B + C + D + E$?

- (A) 14 (B) 16 (C) 24 (D) 26 (E) 34

$$\begin{array}{r} A B C \\ + B C D \\ + C D E \\ + D E A \\ + E A B \\ \hline 2 6 6 4 \end{array}$$

A9 Let a , b and c be integers satisfying $1 \leq a \leq b \leq c$ and $a \times b \times c = 10\,000$. What is the largest possible value of b ?

- (A) 10 (B) 25 (C) 50 (D) 100 (E) 200

A10 A father lives together with his three children. Every year at Christmas they vote on where to go for their summer vacation. The age of each one gives their number of votes. This year the father has 36 votes, the children have 10, 8 and 5 votes. So no matter how the children vote, the father wins. How many years have to pass before the father can be outvoted?

- (A) 5 (B) 6 (C) 7 (D) 13 (E) 14

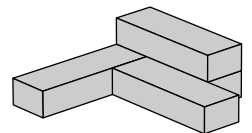
4 point problems

B1 There are 5 coins on the table. All of them show "heads". In each move exactly 3 coins are turned over. What is the smallest number of moves needed for all coins to show "tails"?

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

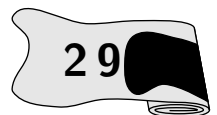
B2 Four identical boxes were glued together as in the diagram. To completely paint all 6 sides of one box, 200 ml of paint is needed. How much paint is needed to completely paint all sides of the whole construction (including the bottom)?

- (A) 500 ml (B) 550 ml (C) 600 ml (D) 700 ml (E) 750 ml



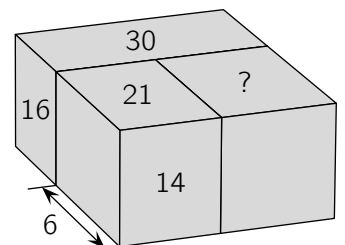
B3 The first two digits of a 10-digit number are 2 and 9. How many digits does the square of this number have?

- (A) 11 (B) 15 (C) 19 (D) 21 (E) 22



B4 Three cuboids were arranged to make a larger cuboid. The diagram shows the length of one edge of one cuboid and the areas of four faces of the cuboids. What is the area of the face with the question mark?

- (A) 21 (B) 24 (C) 25.5 (D) 27 (E) 28.5



B5 If a , b and c are integers, which of the following numbers is certainly not equal to $(a - b)^2 + (b - c)^2 + (c - a)^2$?

- (A) 0 (B) 1 (C) 2 (D) 6 (E) 8

B6 If s screws weigh g grams and n nuts weigh the same as m screws, how many grams does one nut weigh?

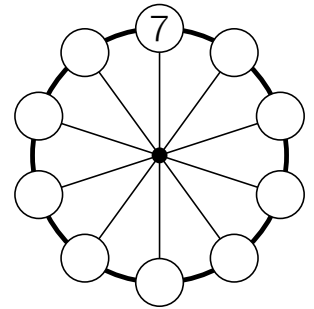
- (A) $\frac{gm}{sn}$ (B) $sgnm$ (C) $\frac{sg}{nm}$ (D) $\frac{gn}{sm}$ (E) $\frac{sm}{gn}$

B7 The sequence f_n is given by $f_1 = 1$, $f_2 = 3$ and $f_{n+2} = f_n + f_{n+1}$ for $n \geq 1$. How many of the first 2020 elements of the sequence are even numbers?

- (A) 673 (B) 674 (C) 1010 (D) 1011 (E) 1347

B8 Matjaz has written a natural number in each of the ten small circles. In the circle at the top is a 7. All around the circle the sum of the numbers in four consecutive circles is always the same. The sum of all ten numbers in the circles is one of the following numbers. Which one?

- (A) 147 (B) 325 (C) 512 (D) 621 (E) 777

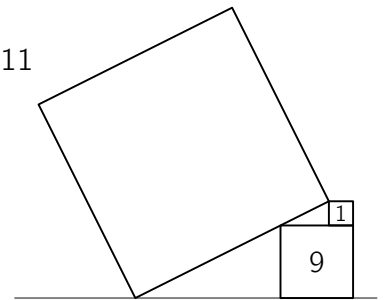


B9 The natural number N is divisible by exactly eight of the ten numbers from 2 to 11. Which two numbers could be the two numbers that do not divide N ?

- (A) 2 and 3 (B) 4 and 5 (C) 6 and 7 (D) 7 and 8 (E) 10 and 11

B10 On a square with area 9 and a square with area 1, a larger square “leans”, as shown in the diagram. What is the area of this square?

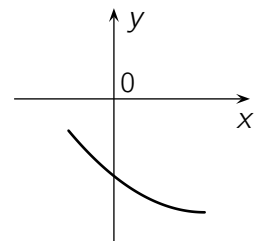
- (A) 37 (B) 50 (C) 65 (D) 80 (E) 99



5 point problems

C1 The diagram shows a part of the graph of the quadratic function $f(x) = ax^2 + bx + c$. Which of the following numbers is positive?

- (A) c (B) $b + c$ (C) ac (D) bc (E) ab

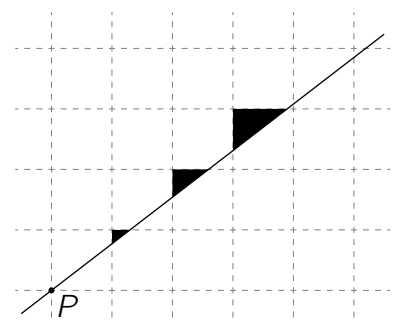


C2 Yesterday morning in the ice cream shop, Hannah wanted to buy a cone with two different flavours of ice cream. In the evening, Hannah’s sister wanted to buy a cone with three different flavours of ice cream. In the morning, there were 16 different flavours to choose from. In the evening some flavours were already sold out. For the chosen number of flavours, Hannah and her sister had the same number of possible combinations to choose from. How many flavours were sold out in the evening?

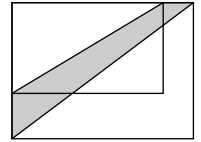
- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

C3 On a sheet with a square grid, a line was drawn through the grid point P . What is the ratio between the areas of the three black triangles?

- (A) 1 : 2 : 3 (B) 1 : 2 : 4 (C) 1 : 3 : 9 (D) 1 : 4 : 8 (E) 1 : 4 : 9



C4 The larger rectangle in the diagram is by 20% longer and by 50% wider than the smaller one. The grey area between the two diagonals of the rectangles is 30 m^2 . What is the area of the smaller rectangle?

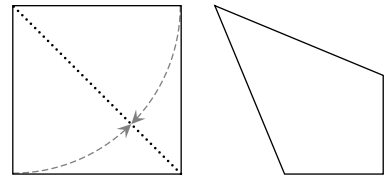


- (A) 60 m^2 (B) 65 m^2 (C) 70 m^2 (D) 75 m^2 (E) 80 m^2

C5 Toni bakes a large number of maxi salami pizzas for the school festival, each with 30 slices of salami. In the refrigerator there are 71 salami slices in a tin and additionally some packages with 18 salami slices each. At least how many slices of salami will be left at the end of the day?

- (A) 1 (B) 3 (C) 5 (D) 7 (E) 9

C6 Helena has a square sheet of paper with side length 1. She folds two sides of the square onto the diagonal (see diagram). What is the area of the resulting kite?

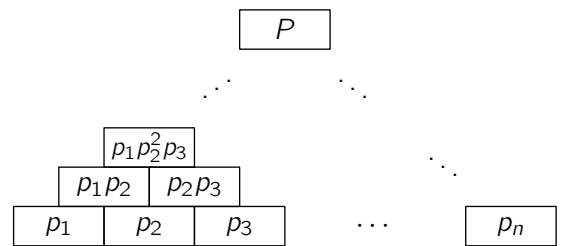


- (A) $2 - \sqrt{2}$ (B) $\frac{\sqrt{2}}{2}$ (C) $\sqrt{2} - 1$ (D) $\frac{7}{10}$ (E) $\frac{3}{5}$

C7 In Robert the giant's cocktail are huge ice cubes. 90% (of the volume) of the uppermost one cannot be seen, only a corner sticks out. The parts of the three edges of the cube that stick out are 7.2 cm, 7.5 cm and 8.1 cm long. What is the length of the edges of the uppermost ice cube in Robert's cocktail?

- (A) 9.0 cm (B) 9.9 cm (C) 10.2 cm (D) 10.5 cm (E) 11.7 cm

C8 In the bottom row of a number pyramid there are n different prime numbers (p_1 to p_n). From the second row on, each number is the product of the two numbers directly below it (see diagram). In the topmost field is the number $P = (p_1)^{k_1} \times (p_2)^{k_2} \times (p_3)^{k_3} \times (p_4)^{k_4} \times \dots \times (p_n)^{k_n}$. If $k_2 = 8$, what is the value of k_4 ?

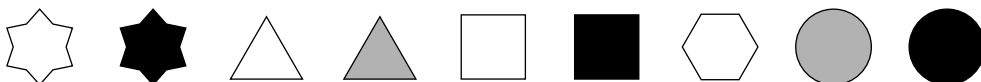


- (A) 42 (B) 48 (C) 49 (D) 56 (E) 64

C9 In the computer room we have 25 racing robots, which all have different speeds. We're supposed to determine the three fastest. On a test track five robots compete against each other in every race. Before each race it can be chosen which five robots will race. After each race, only the order in which the robots crossed the finish line is announced. We have to come up with a strategy how to find out which three robots are the fastest using N races (no matter what the outcome of these races are). What is the smallest possible value for N to do this?

- (A) 6 (B) 7 (C) 8 (D) 9 (E) 10

C10 Xenia and Ysette want to know which of the following figures Zita likes best:



Xenia knows that Zita told Ysette the shape of this figure, and Ysette knows that Zita told Xenia the colour of this figure. Xenia says to Ysette: "I don't know the figure that Zita likes best. However, I also know that you can't know it either." Ysette replies: "I didn't know the figure a moment ago, but now I do." Xenia replies: "Now I know the figure too!" Which figure does Zita like best?

- (A)  (B)  (C)  (D)  (E) 