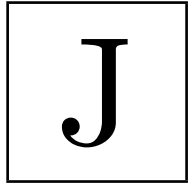


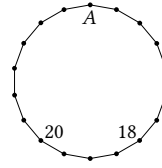
# KANGAROO 2018



**Junior**  
9–10 grades

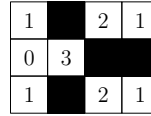
Time allowed: 75 minutes  
Calculators are not permitted

25. At each vertex of the 18-gon in the picture an integer should be written which is equal to the sum of the numbers at the two adjacent vertices. Two of the numbers are given. What number should be written at the vertex  $A$ ?



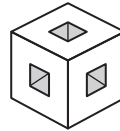
- A) 2018 B)  $-20$  C) 18 D) 38 E)  $-38$

26. Diana draws a rectangular grid of 12 squares on squared paper. Some of the squares are painted black. In each blank square she writes the number of black squares that share a side with it. The figure shows an example. Now she does the same in a rectangular grid  $3 \times 11$ . What is the maximum value that she can obtain as the result of the sum of all the numbers in the grid?



- A) 25 B) 30 C) 33 D) 52 E) 55

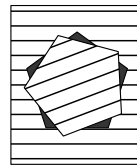
27. Seven small cubes have been deleted from a  $3 \times 3 \times 3$  cube (see the picture which shows any three adjacent faces of the cube). We cut this cube by the plane passing through the centre of the cube and perpendicular to one of its four big diagonals. What will the cross-section look like?



- A) B) C) D) E)

28. Each number of the set  $\{1, 2, 3, 4, 5, 6\}$  is written into a cell of a  $2 \times 3$  table (no cells are left empty). In how many ways can this be done such that in each row and in each column the sum of the numbers is divisible by 3?

- A) 36 B) 42 C) 45 D) 48 E) 54

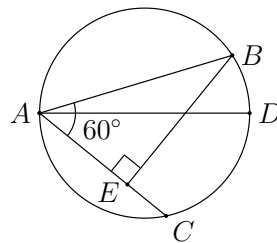


29. We cut out a regular pentagon from a lined piece of paper. In each step we rotate the pentagon counterclockwise around its centre by  $21^\circ$ . The situation after the first step is shown. What will we see when the pentagon first fits back in the hole?

- A) B) C) D) E)

30. Two chords  $AB$  and  $AC$  are drawn in a circle with diameter  $AD$  (see pic.). The angle  $\angle BAC = 60^\circ$ ,  $BE \perp AC$ ,  $EC = 3$ . What is the length of the chord  $BD$ ?

- A)  $\sqrt{3}$  B) 2 C) 3 D)  $2\sqrt{3}$  E)  $3\sqrt{2}$

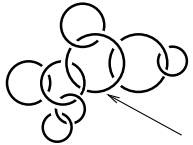


1. Among Mr. Smith's children, every child has at least two brothers and at least one sister. What is the smallest possible number of children in Smith's family?

- A) 3 B) 4 C) 5 D) 6 E) 7

2. Some of the rings lying on the table are connected (see pic.). The ring indicated by the arrow will be removed. How many rings in total will be removed?

- A) 3 B) 4 C) 5 D) 6 E) 7

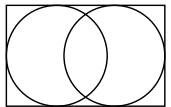


3. The lengths of the two sides of the triangle are 5 and 2, and the length of the third side is an odd integer number. Find the length of the third side.

- A) 3 B) 4 C) 5 D) 6 E) 7

4. The diagram shows a rectangle of dimensions  $7 \times 11$  containing two circles that each touch three of the sides of the rectangle. What is the distance between the centres of the two circles?

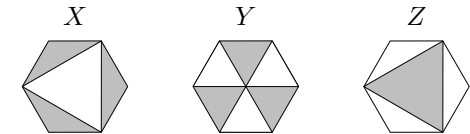
- A) 1 B) 2 C) 3 D) 4 E) 5



5. The sum of 5 consecutive integers is  $10^{2018}$ . What is the middle number?

- A)  $10^{2013}$  B)  $5^{2017}$  C)  $10^{2017}$  D)  $2^{2018}$  E)  $2 \cdot 10^{2017}$

6. Given three congruent regular hexagons, we call  $X$ ,  $Y$ ,  $Z$  the total area of the shaded zones in each one of the figures. 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) Each of the three areas  $X, Y, Z$  has a different value

7. Mary has collected 42 apples, 60 apricots and 90 cherries. She wants to divide them into identical piles using all of the fruit and then give a pile to each of her friends. What is the largest number of piles she can make?

- A) 3 B) 6 C) 10 D) 14 E) 42

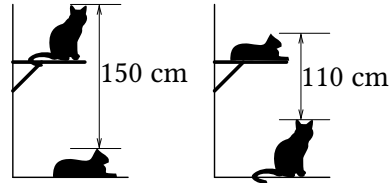
8. Some of the digits in the following correct addition have been replaced by the letters  $P$ ,  $Q$ ,  $R$  and  $S$ , as shown. How much is  $P + Q + R + S$ ?

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

$$\begin{array}{r} P\ 4\ 5 \\ +\ Q\ R\ S \\ \hline 6\ 5\ 4 \end{array}$$

9. What is the sum of 25% of 2018 and 2018% of 25?  
A) 1009 B) 2016 C) 2018 D) 3027 E) 5045

10. The distance from the top of the sleeping cat on the floor to the top of the cat sitting on the table is 150 cm. The distance from the top of the cat sitting on the floor to the top of the cat sleeping on the table is 110 cm. What is the height of the table?

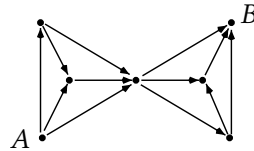


A) 110 cm B) 120 cm C) 130 cm D) 140 cm E) 150 cm

#### Questions for 4 points

11. In the picture shown you should go from  $A$  to  $B$  following the arrows. How many different routes are there?

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



12. There are 105 numbers written in a row: 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, ... (Each number  $n$  is written exactly  $n$  times.) How many of these numbers are divisible by 3?

A) 4 B) 12 C) 21 D) 30 E) 45

13. A lion is hidden in one of three rooms. A note on the door of room 1 reads "The lion is here". A note on the door of room 2 reads "The lion is not here". A note on the door of room 3 reads " $2 + 3 = 2 \times 3$ ". Only one of these sentences is true. In which room is the lion hidden?

A) In room 1 B) In room 2 C) In room 3 D) It may be in any room  
E) It may be in either room 1 or room 2

14. 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 there are 150 students living in the second building. Where should a bus stop be built so that the total distance that all residents of both buildings have to walk from this bus stop to their buildings would be the least possible?

A) Anywhere between the buildings B) In front of the first building  
C) 100 m from the first building D) 100 m from the second building  
E) In front of the second building

15. How many digits has the number resulting from this calculation:  $\frac{1}{9} \times 10^{2018} \times (10^{2018} - 1)$ ?

A) 2017 B) 2018 C) 4035 D) 4036 E) 4037

16. Peter wanted to buy a book, but he didn't have any money. The sum he needed was given to him by his father and two brothers. His father gave him half of the amount given by his brothers. His elder brother gave him one third of what the others gave. The younger brother gave him 10 EUR. What was the price of the book?

A) 24 EUR B) 26 EUR C) 28 EUR D) 30 EUR E) 32 EUR

17. How many 3-digit numbers are there with the property that the 2-digit number obtained by deleting the middle digit is equal to one ninth of the original 3-digit number?

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

18. In the calculation shown, how many times does the term  $2018^2$  appear inside the square root to make the calculation correct?

$$\sqrt{2018^2 + 2018^2 + \dots + 2018^2} = 2018^{10}$$

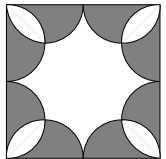
A) 5 B) 8 C) 18 D)  $2018^8$  E)  $2018^{18}$

19. At the University of Humanities you can study languages, history and philosophy. 35% of students that study languages, study English. 13% of the university students study a language other than English. No student studies more than one language. What percentage of the university students study languages?

A) 13% B) 20% C) 22% D) 48% E) 65%

20. Eight congruent semicircles are drawn inside a square of side length 4. What is the area of the non-shaded part of the square?

A)  $2\pi$  B)  $3\pi$  C)  $6 + \pi$  D)  $3\pi - 2$  E) None of these



#### Questions for 5 points

21. Several integers are written on a blackboard, including the number 2018. The sum of all these integers is 2018. The product of these integers is also 2018. Which of the following could be the number of integers written on the blackboard?

A) 2016 B) 2017 C) 2018 D) 2019 E) 2020

22. Four positive numbers are given. You choose three of them, calculate their arithmetic mean and then add the fourth number. This can be done in four different ways. The results are 17, 21, 23 and 29 respectively. What is the largest of the initial four numbers?

A) 12 B) 15 C) 21 D) 24 E) 29

23. There are two diagonals drawn in a regular 2018-gon with its vertices consecutively numbered from 1 to 2018. One diagonal connects the vertices with the numbers 18 and 1018, the other connects the vertices with the numbers 1018 and 2000. How many vertices do the resulting three polygons have?

A) 38, 983, 1001 B) 37, 983, 1001 C) 38, 982, 1001 D) 37, 982, 1000  
E) 37, 983, 1002

24. On a certain day 40 trains each travelled between two of the towns  $M$ ,  $N$ ,  $O$ ,  $P$  and  $Q$ . 10 trains travelled either from or to  $M$ . 10 trains travelled either from or to  $N$ . 10 trains travelled either from or to  $O$ . 10 trains travelled either from or to  $P$ . How many trains travelled from or to  $Q$ ?

A) 0 B) 10 C) 20 D) 30 E) 40