23. The length of one of the sides of a rectangular garden is increased by 20% and the length of the other side is increased by 50%. The new garden is a square, as shown in the diagram. The shaded area between the diagonal of the square garden and the diagonal of the original rectangular garden is $30\,\text{m}^2$. What was the area of the original rectangular garden?
A) $60\,\text{m}^2$ B) $65\,\text{m}^2$ C) $70\,\text{m}^2$ D) $75\,\text{m}^2$ E) $80\,\text{m}^2$
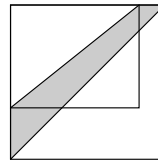
24. The sequence $L_1, L_2, L_3, \ldots$ is given by $L_1 = 1$, $L_2 = 3$ and $L_{n+2} = L_n + L_{n+1}$ for $n \geq 1$. How many of the first 2020 elements of the sequence are even?
A) 673   B) 674   C) 1010   D) 1011   E) 1347

25. An iceberg has the shape of a cube. Exactly 90% of its volume is hidden below the surface of the water. Three edges of the cube are partially visible over the water. The visible parts of these edges are 24 m, 25 m and 27 m. How long is an edge of the cube?
A) 30 m   B) 33 m   C) 34 m   D) 35 m   E) 39 m

26. In the morning, the ice-cream shop offers 16 flavours. Anna wants to choose a 2-flavour ice cream. In the evening several flavours are sold out and Bella wants to choose a 3-flavour ice cream from those flavours left. Both Anna and Bella can choose from the same number of possible combinations. How many flavours were sold out?
A) 2   B) 3   C) 4   D) 5   E) 6

27. Wajda took a square piece of paper of side 1 dm and folded two of its sides to the diagonal, as shown in the diagram, to make a quadrilateral. What is the area of this quadrilateral (in dm^2)?
A) $2 - \sqrt{2}$ B) $\frac{\sqrt{2}}{2}$ C) $\sqrt{2} - 1$ D) $\frac{7}{10}$ E) $\frac{3}{5}$

28. A large integer N is divisible by all except two of the integers from 2 to 11. Which of the following pairs of integers could be these exceptions?
A) 2 and 3   B) 4 and 5   C) 6 and 7   D) 7 and 8   E) 10 and 11

29. On a square grid paper, a little kangaroo draws a line passing through the lower left corner P of the grid and colours in three triangles as shown. Which of the following could be the ratio of the areas of the triangles?
A) $1 : 2 : 3$ B) $1 : 2 : 4$ C) $1 : 3 : 9$ D) $1 : 4 : 8$
E) None of the previous is correct

30. Adam and Britt try to find out which of the following figures is Carl's favourite.

Adam knows that Carl has told Britt its shape. Britt knows that Carl has told Adam its colour. Then the following conversation takes place. Adam: "I don't know Carl's favourite figure and I know that Britt doesn't know it either." Britt: "At first I didn't know Carl's favourite figure, but now I do." Adam: "Now I know it too." Which figure is Carl's favourite?
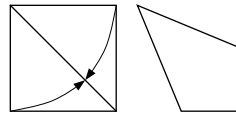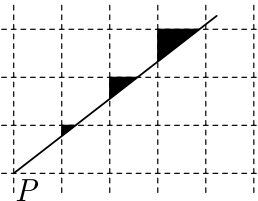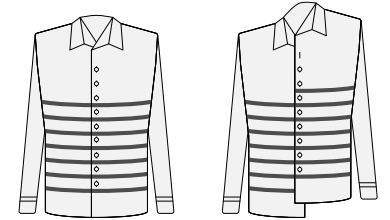
A)   B)   C)   D)   E)

KANGAROO 2020

S
EN

Student
11–12 grades

Time allowed: 75 minutes
*Calculators are not permitted*

Questions for 3 points

1. What is the sum of the last two digits of the product $1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$?
A) 2   B) 4   C) 6   D) 8   E) 16

2. When Cosmo wears his new shirt properly as shown on the left, the horizontal stripes form seven closed rings around his waist. This morning he buttoned his shirt wrongly, as shown on the right. How many closed rings were there around Cosmo's waist this morning?
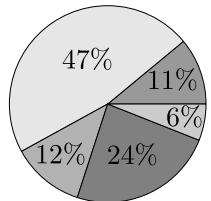A) 0   B) 1   C) 3   D) 6   E) 7

3. Rene marked two points a and b as accurately as possible on the number line. Which of the points p, q, r, s, t on the number line best represents their product ab?
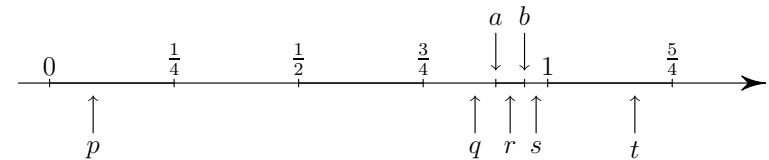
A) p B) q C) r D) s E) t

4. The pie chart shows how the students of my school get to school. Approximately twice as many go by bike as use public transport and roughly the same number come by car as walk. The rest use a moped. What percentage use a moped?
A) 6%   B) 11%   C) 12%   D) 24%   E) 47%

5. The sum of five three-digit numbers $\overline{ABC}, \overline{BCD}, \overline{CDE}, \overline{DEA}$ and $\overline{EAB}$ is 2664. What is the value of $A + B + C + D + E$?
A) 4   B) 14   C) 24   D) 34   E) 44

6. $\dfrac{1010^2 + 2020^2 + 3030^2}{2020} =$
A) 2020   B) 3030   C) 4040   D) 6060   E) 7070

7. Let a, b and c be integers satisfying $1 \leqslant a \leqslant b \leqslant c$ and $abc = 1\,000\,000$. What is the largest possible value of b?
A) 100 **B)** 250 **C)** 500 **D)** 1000 **E)** 2000

8. Mary has ten pieces of paper. Some of these are squares and the rest are triangles. She cuts three squares diagonally from corner to corner. She counts the total number of vertices of the 13 pieces of paper she now has and gets the answer 42. How many triangles did she have before making the cuts?
A) 8 **B)** 7 **C)** 6 **D)** 5 **E)** 4

9. If P dogs weigh K kilograms and D elephants weigh the same as M dogs, how many kilograms does one elephant weigh?
A) $PKDM$ **B)** $\frac{PK}{DM}$ **C)** $\frac{KD}{PM}$ **D)** $\frac{KM}{PD}$ **E)** $\frac{PM}{KD}$

10. There are two dice. Each one has two red faces, two blue faces and two white faces. If we roll both dice together, what is the probability that both show the same colour?
A) $\frac{1}{12}$ **B)** $\frac{1}{9}$ **C)** $\frac{1}{6}$ **D)** $\frac{2}{9}$ **E)** $\frac{1}{3}$

Questions for 4 points

11. A big rectangle and a small rectangle are overlapping. The figure shows 4 different such cases. We denote by B the area of the part of the big rectangle that is not common to the two rectangles, and we denote by S the area of the small rectangle that is not common to the two. In which case the quantity $B - S$ is the largest?

I   II   III   IV

A) I **B)** II **C)** III **D)** IV **E)** The quantity $B - S$ is the same in all cases
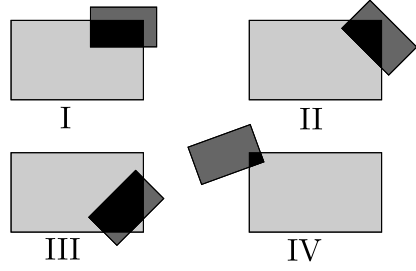
12. Five coins are lying on a table with the "heads" side up. At each step you must turn over exactly three of the coins. What is the least number of steps required to have all the coins lying with the "tails" side up?
A) 5 **B)** 4 **C)** 3 **D)** 2 **E)** It's not possible to have all the coins with their "tails" side up

13. The shortest path from Atown to Cetown runs through Betown. Walking on this path from Atown to Cetown, we would first find the signpost shown on the left. Later we would find the signpost shown on the right. What distance was written on the broken sign?
**A)** 1 km **B)** 2 km **C)** 3 km **D)** 4 km **E)** 5 km

Atown 3 km / Betown 1 km / Cetown 9 km
Atown 6 km / Betown ? km / Cetown 6 km
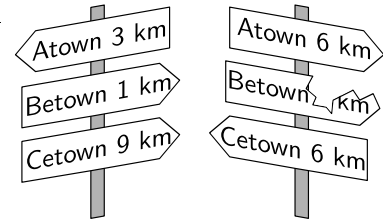
14. Let a, b and c be integers. Which of the following is certainly NOT equal to $(a-b)^2 + (b-c)^2 + (c-a)^2$?
A) 0 **B)** 1 **C)** 2 **D)** 6 **E)** 8

15. The first two digits of a 100-digit integer are 29. How many digits does the square of this number have?
A) 101 **B)** 199 **C)** 200 **D)** 201 **E)** It cannot be determined

16. Matjaz has placed 15 numbers on a wheel. Only one of the numbers is visible, the 10 at the top. The sum of the numbers in any 7 consecutive positions on the wheel, such as the ones shaded grey, is always the same. When all 15 numbers are added, exactly how many of the numbers 75, 216, 365 and 2020 are possible totals?
**A)** 0 **B)** 1 **C)** 2 **D)** 3 **E)** 4
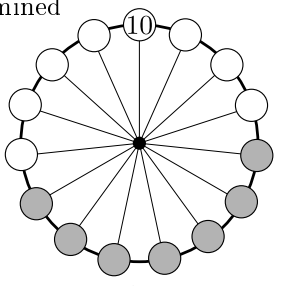
17. A large square touches two other squares, as shown in the diagram. The numbers in the small squares represent their areas. What is the area of the large square?
**A)** 49 **B)** 80 **C)** 81 **D)** 82 **E)** 100
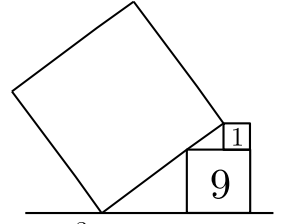
18. Which of the following numbers is not divisible by 3 for any integer n?
A) $n^{12} + 2n^{11} + 1$ **B)** $5n^{12} - n^{11} + 2$ **C)** $5n + 2$ **D)** $n^2 + 2n + 5$ **E)** $2n^3 + 5$

19. A circle and a rectangle have been drawn in such a way that the circle touches two of the sides of the rectangle and passes through one of its vertices. The distances of two vertices of the rectangle from one of the points where the circle touches the rectangle are 5 and 4, as shown. What is the area of the rectangle?
**A)** 27π **B)** 25π **C)** 72 **D)** 63 **E)** None of the previous

5   4
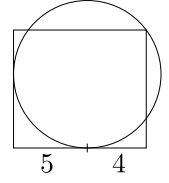
20. Three cuboids are arranged to make a larger cuboid as in the figure. The width of one of them is 6 and the areas of some of their faces are 14, 21, 16, 30, as shown. What is the area of the face with the question mark?
A) 18 **B)** 24 **C)** 28 **D)** 30 **E)** It cannot be determined

30   21   ?   16   14   6
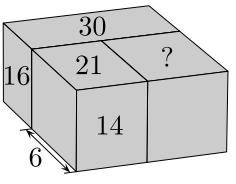
Questions for 5 points

21. The figure shows a section of the parabola with equation $y = ax^2 + bx + c$. Which of the following numbers is positive?
A) c **B)** $b+c$ **C)** ac **D)** bc **E)** ab
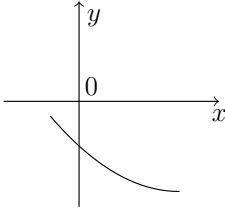
22. Tony has 71 marbles at his disposal in a box. He is allowed to take out exactly 30 marbles from the box or to return exactly 18 marbles to it. Tony is allowed to apply each operation as many times as he wishes. What is the smallest number of marbles that can be in the box?
A) 1 **B)** 3 **C)** 5 **D)** 7 **E)** 11