KÄNGURU DER MATHEMATIK 2023
16. 3. 2023

Level: Kadett, Grade: Schulstufe 7 + 8

Name:	
School:	
Class:	

Time: 75 min.
30 starting points
each correct answer to questions 1. – 10.: 3 points
each correct answer to questions 11. – 20.: 4 points
each correct answer to questions 21. – 30.: 5 points
each questions left unanswered: 0 points
each incorrect answer: minus ¼ of the points for the question

Please write the letter (A, B, C, D, E) of the correct answer in the square under the question number (1 bis 30). Write clearly and carefully!

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15	16	17	18	19	20

21	22	23	24	25	26	27	28	29	30

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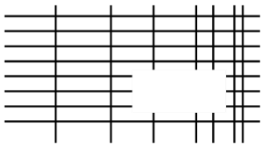
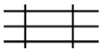
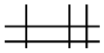
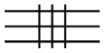
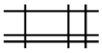
Information über den Känguruwettbewerb: www.kaenguru.at
Wenn du mehr in dieser Richtung machen möchtest,
gibt es die Österreichische Mathematikolympiade.
Infos unter: www.oemo.at

Känguru der Mathematik 2023
Level Kadett (Schulstufe 7 and 8)
Austria – 16. 3. 2023

- 3 Point Examples -

1. The diagram shows a grid made of vertical and horizontal lines.
Which part was cut from the grid?



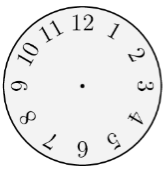
(A)  (B)  (C)  (D)  (E) 

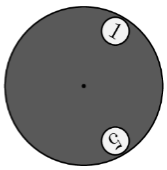
2. Which of the following shapes **cannot** be cut into two trapeziums with one single straight line?

(A)  (triangle) (B)  (rectangle) (C)  (trapezium)

(D)  (regular hexagon) (E)  (square)

3. A dark disc with two holes is placed on top of a dial of a watch as shown. The dark disc is now rotated so that the number 8 can be seen through one of the holes.
Which of the numbers could one see through the other hole now?



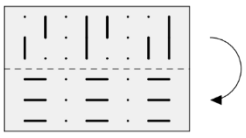


(A) 4 and 12 (B) 1 and 5 (C) 1 and 4 (D) 7 and 11 (E) 5 and 12

4. John throws 150 coins onto a table. 60 of them show „head“, the others show „tail“. He wants the same amount of coins to show „head“ as „tail“. How many coins that show „head“ does he have to turn over?

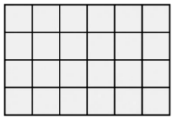
(A) 10 (B) 15 (C) 20 (D) 25 (E) 30

5. Kristina has a piece of see-through foil on which some points and lines are drawn. She folds the foil along the dotted line.
What can she see now?



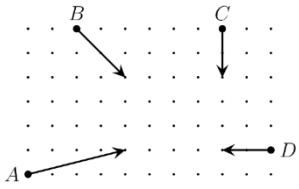
(A)  (B)  (C)  (D)  (E) 

6. A grid should be cut along the black lines into several identical shapes. No piece is to be left over.
Into which of the following shapes is it **not** possible to cut this grid in this way?



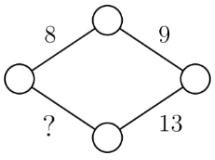
(A)  (B)  (C)  (D)  (E) 

7. The diagram shows the starting position, the direction and the distance covered within 5 seconds by four bumper cars.
Which two cars will first crash into each other?



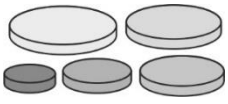
(A) A and B (B) A and C (C) A and D (D) B and C (E) C and D

8. Werner wants to label each side and each corner point of the rhombus shown with exactly one number. He wants the number on each side to be equal to the sum of the numbers on the corner points of that sides.
Which number is he going to write in the place of the question mark?



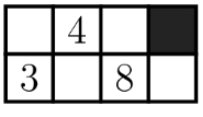
(A) 11 (B) 12 (C) 13 (D) 14 (E) 15

9. Anna has five circular discs that are all of different sizes. She wants to build a tower using three discs where a smaller disc always has to lie on top of a bigger disc.
How many ways are there for Anna to build the tower?



(A) 5 (B) 6 (C) 8 (D) 10 (E) 15

10. Evita wants to write the numbers from 1 to 8 with one number in each field. The sum of the numbers in each row should be equal. The sum of the numbers in the four columns should also be the same. She has already written in the numbers 3, 4 and 8 (see diagram).
Which number does she have to write in the dark field?

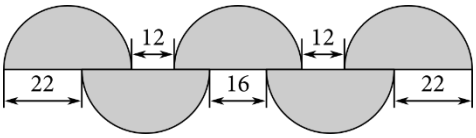


(A) 1 (B) 2 (C) 5 (D) 6 (E) 7

- 4 Point Examples-

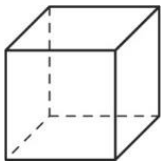
11. Dorli writes down three consecutive natural numbers in increasing order.
She replaces the digits using symbols and gets: □♦♦, ♡ΔΔ, ♡Δ□.
What would be the next bigger number in this notation?
(A) ♡♡♦ (B) □♡□ (C) ♡Δ♦ (D) ♡♦□ (E) ♡Δ♡

12. The diagram shows 5 equally big semicircles and the length of 5 distances.
How big is the radius of one semicircle?



(A) 12 (B) 16 (C) 18 (D) 22 (E) 36

13. Some edges of a cube are coloured in red so that each sides of the cube has at least one red edge.
What is the minimum number of red edges that the cube has?



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

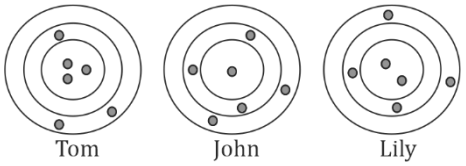
14. The digits 0 to 9 can be formed using matchsticks (see diagram).
How many different positive whole numbers can be formed this way with exactly 6 matchsticks?

(A) 2 (B) 4 (C) 6 (D) 8 (E) 9

15. The side lengths of a square are 1 cm long.
How many points on a plane surface are there that are exactly 1 cm away from two corner points of the square?
(A) 4 (B) 5 (C) 6 (D) 10 (E) 12

16. Some kangaroos and three beavers are standing in a circle. No beaver stands directly next to another beaver. There are exactly three kangaroos that are standing next to another kangaroo.
What is the biggest possible number of kangaroos in the circle?
(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

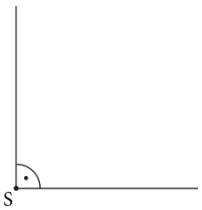
17. Tom, John and Lily have each shot 6 arrows on a disc with three sections (see diagram). The number of points of a hit depends on the section that has been hit. Tom has 46 points and John has 34 points. How many points did Lily get?



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

18. Max and two of his friends are standing in a line. The number of people in the line is a multiple of 3. He realises that there are the same number of people in front of him as there are behind him. His two friends are both behind him: one is in position 19, the other one in position 28 of the line. In which position of the line is Max?
(A) 14. (B) 15. (C) 16. (D) 17. (E) 18.

19. Two rays starting in *S* form a right angle. More rays starting in *S* are drawn within the right angle so that each angle 10°, 20°, 30°, 40°, 50°, 60°, 70° and 80° is enclosed by two rays.
What is the minimum number of rays that have to be drawn?

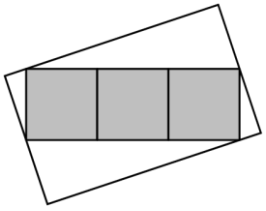


(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

20. The sum of 2023 consecutive integers is 2023.
What is the sum of the digits of the biggest of those numbers?
(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

- 5 Point Examples -

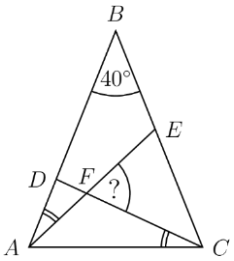
21. The diagram shows a grey rectangle that lies within a bigger rectangle which sides it touches. Two corner points of the grey rectangle are the midpoints of the shorter sides of the bigger rectangle. The grey rectangle is made up of three squares that each have an area of 25 cm^2.
How big is the area of the bigger rectangle in cm^2?



(A) 125 (B) 136 (C) 149 (D) 150 (E) 172

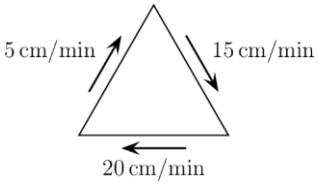
22. Snow White organises a chess tournament for the seven dwarfs lasting several days. Every dwarf has to play every other dwarf exactly once.
On Monday Grumpy plays 1 game, Sneezy plays 2, Sleepy 3, Bashful 4, Happy 5 and Doc 6 games.
How many games does Dopey, the 7th dwarf, play on Monday?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

23. The shown triangle ABC is isosceles with $\sphericalangle ABC = 40°$.
The two angles indicated $\sphericalangle EAB$ and $\sphericalangle DCA$ are equally big.
How big is the angle $\sphericalangle CFE$?



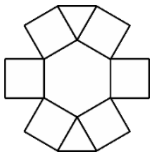
(A) 55° (B) 60° (C) 65° (D) 70° (E) 75°

24. An ant walks along the sides of an equilateral triangle (see diagram). Its velocity is 5 cm/min along the first side, 15 cm/min along the second and 20 cm/min along the third.
With which average velocity in cm/min does the ant walk once around the entire triangle?



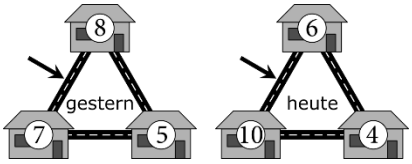
(A) 10 (B) $\frac{80}{11}$ (C) $\frac{180}{19}$ (D) 15 (E) $\frac{40}{3}$

25. Elisabeth wants to write the numbers 1 to 9 in the fields of the diagram shown so that the product of the numbers of two fields next to each other is no greater than 15.
Two fields are called „next to each other“ if they share a common edge.



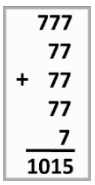
How many ways are there for Elisabeth to label the fields?
(A) 8 (B) 12 (C) 16 (D) 24 (E) 32

26. Several mice live in three houses. Last night every mouse left their house and moved directly to one of the other two houses. The diagram shows how many mice were in each house yesterday and today.
How many mice used the path that is indicated with an arrow?



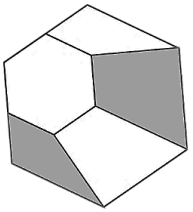
(A) 9 (B) 11 (C) 12 (D) 16 (E) 19

27. Bart wrote the number 1015 as a sum of numbers that are made up of only the digit 7. In total he uses the digit 7, 10 times. Now he wants to the write the number 2023 as a sum of numbers that are made up of only the digit 7. He uses the digit 7, 19 times in total.
How often does he have to use the number 77?



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

28. A regular hexagon is split into four quadrilaterals and a smaller regular hexagon.
The ratio $\frac{Area\ of\ the\ dark\ sections}{Area\ of\ the\ small\ hexagon} = \frac{4}{3}$.



How big is the ratio $\frac{Area\ of\ the\ small\ hexagon}{Area\ of\ the\ big\ hexagon}$?
(A) $\frac{3}{11}$ (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) $\frac{3}{4}$ (E) $\frac{3}{5}$

29. Jakob wrote six consecutive numbers on six little pieces of white paper, one number per piece of paper. He stuck those six pieces of paper on the front and back of three coins. Then he threw the coins three times. After the first throw the numbers 6, 7, 8 were on top (see diagram) which Jakob then coloured in red.
After the second throw the sum of the numbers on top was 23 and after the third throw the sum was 17.
How big is the sum of the numbers on the three white pieces of paper?

(A) 18 (B) 19 (C) 23 (D) 24 (E) 30

30. A rugby team scored 24, 17 and 25 points in their 7th , 8th and 9th game of the previous season. The average number of points per game was higher after 9 games than after their first 6 games. Their average after 10 games was more than 22 points. What is the minimum number of points they have scored in their 10th game?
(A) 22 (B) 23 (C) 24 (D) 25 (E) 26