

# KÄNGURU DER MATHEMATIK 2022

17. 3. 2022



Level: Junior, Grades 9 - 10

Full 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  $\frac{1}{4}$  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

### Zustimmungserklärung zur Datenverarbeitung für den österreichischen Wettbewerb „Känguru der Mathematik“

Mit meiner Unterschrift gebe ich das Einverständnis, dass meine angeführten personenbezogenen Daten (Vor- und Zuname, Klasse, Schulstufe, Schulstandort und Schulart) zum Zweck der Organisation und Durchführung des Wettbewerbs, der Auswertung der Wettbewerbsergebnisse (Ermitteln der erreichten Punkte und Prozentzahlen), des Erstellens von schulweiten Reihungen, sowie zur Erstellung und Veröffentlichung der Siegerlisten auf unserer Vereinshomepage (sofern mindestens 50 % der zu erreichenden Punktezahl erlangt werden bzw. ich unter den besten 10 einer Kategorie liege) verwendet werden dürfen.

### Betroffenenrechte

Die Verwendung dieser Daten ist bis 31. Dezember des 2. Folgejahres gestattet. Nach diesem 31. Dezember werden Vor- und Zuname, die Klasse und der Schulstandort gelöscht, wobei dieser durch die Angabe des Bundeslandes ersetzt wird. Die Verwendung der auf diese Art anonymisierten Daten ist nur mehr für statistische Zwecke auf der Grundlage der DSGVO erlaubt.

Ich habe ein Recht auf Auskunft über meine gespeicherten personenbezogenen Daten, sowie das Recht auf Berichtigung, Datenübertragung, Widerspruch, Einschränkung der Bearbeitung sowie Sperrung oder Löschung unrichtig verarbeiteter Daten.

Ich kann die erteilte Einwilligung jederzeit auf der Homepage des Vereines Känguru der Mathematik unter [www.kaenguru.at](http://www.kaenguru.at) mittels des dafür bereitgestellten Formulars mit Wirkung für die Zukunft widerrufen (Art. 21 Abs. 1 DSGVO).

Ein Widerruf hat zur Folge, dass die personenbezogenen Daten nach gegenseitiger Rücksprache innerhalb von 31 Tagen gelöscht werden.

Durch den Widerruf wird die Rechtmäßigkeit der aufgrund der Einwilligung bis zum Widerruf erfolgten Verarbeitung nicht berührt. (Art. 7 Abs. 2 DSGVO)



Information über den Känguruwettbewerb: [www.kaenguru.at](http://www.kaenguru.at)

Wenn du mehr in dieser Richtung machen möchtest, gibt es die Österreichische Mathematikolympiade.

Infos unter: [www.oemo.at](http://www.oemo.at)

# Känguru der Mathematik 2022

## Level Junior (Schulstufe 9 and 10)

### Austria – 17. 3. 2022

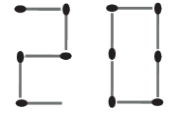


#### - 3 Point Examples -

1. What is  $\frac{20 \cdot 22}{(2+0) \cdot (2+2)}$  ?

- (A) 34      (B) 40      (C) 44      (D) 55      (E) 85

2. Karo has a box of matches with 30 matches. Using some of the matches she forms the number 2022. She has already formed the first two digits (see picture).



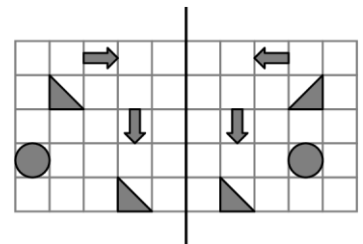
How many matches will be left in the box when she has finished the number?

- (A) 5      (B) 9      (C) 10      (D) 19      (E) 5

3. An equilateral triangle with side length 12 has the same perimeter as a square with side length  $x$ . What is the value of  $x$ ?

- (A) 9      (B) 12      (C) 16      (D) 24      (E) 36

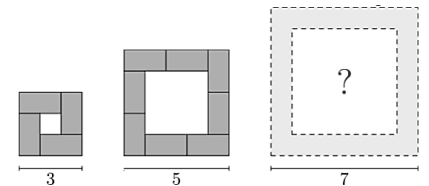
4. Various symbols are drawn on a piece of paper (see picture). The teacher folds the left side along the vertical line to the right.



How many symbols of the left side are now congruent on top of a symbol on the right side?

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

5. Karin places tables of size  $2 \times 1$  according to the number of participants in a meeting. The diagram shows the table arrangements from above for a small, a medium and a large meeting.



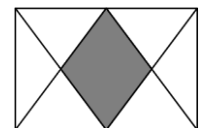
How many tables are used in a large meeting?

- (A) 10      (B) 11      (C) 12      (D) 14      (E) 16

6. I am smaller than my half and bigger than my double. The sum of me and my square is 0. Which number am I?

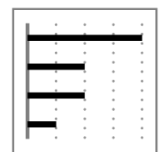
- (A) -2      (B) -1      (C) 0      (D) 1      (E) 2

7. The midpoints of both longer sides of a rectangle are connected with the vertices (see diagram). Which fraction of the rectangle is shaded?



- (A)  $\frac{1}{5}$       (B)  $\frac{1}{4}$       (C)  $\frac{2}{7}$       (D)  $\frac{1}{3}$       (E)  $\frac{2}{5}$

8. Sonja's smartphone displays the diagram on the right. It shows how long she has worked with four different apps in the previous week. This week he has spent only half the amount of time using two of the apps and the same amount of time as last week using the other two apps.



Which of the following pictures could be the diagram for the current week?

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

9. In the multiplication grid displayed, each white cell should show the product of the numbers in the grey cells that are in the same row and column respectively. One number is already entered. The integer  $x$  is bigger than the positive integer  $y$ . What is the value of  $y$ ?

·	x	x+1
y		
y+1		77

- (A) 6      (B) 7      (C) 8      (D) 10      (E) 11

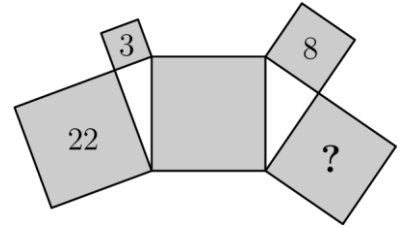
10. There are 5 people to choose from on a ballot paper. After counting 90 % of the votes the intermediate result looks as shown in the table. How many of the 5 people cannot win the election anymore?

Alex	Bella	Clint	Diana	Eddy
14	11	10	8	2

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

**- 4 Point Examples -**

- 11.** Five squares and two right-angled triangles are placed as shown in the diagram. The numbers 3, 8 and 22 in the squares state the size of the area in  $m^2$ . How big is the area (in  $m^2$ ) of the square with the question mark?

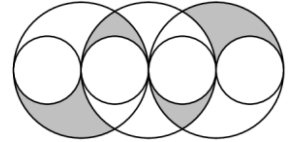


- (A) 14      (B) 15      (C) 16      (D) 17      (E) 18

- 12.** 2022 tiles are placed in one long row. Adam removes every sixth tile. Then Beate removes every fifth of the remaining tiles. Subsequently Cora removes every fourth of the remaining tiles. How many tiles are left?

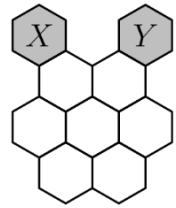
- (A) 0      (B) 337      (C) 674      (D) 1011      (E) 1348

- 13.** The diagram shows three big circles of equal size and four small circles. Each small circle touches two big circles and has radius 1. How big is the shaded area?



- (A)  $\pi$       (B)  $2\pi$       (C)  $3\pi$       (D)  $4\pi$       (E)  $6\pi$

- 14.** A bee called Maja wants to hike from honeycomb X to honeycomb Y. She can only move from one honeycomb to the neighbouring honeycomb if they share an edge. How many, different ways are there for Maja to go from X to Y if she has to step onto every one of the seven honeycombs exactly once?

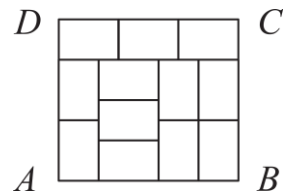


- (A) 2      (B) 3      (C) 4      (D) 5      (E) 6

- 15.** The sum of two positive integers is three times as big as their difference. The product of the two numbers is four times as big as their sum. How big is the sum of the two numbers?

- (A) 9      (B) 10      (C) 12      (D) 15      (E) 18

- 16.** The rectangle  $ABCD$  is made up of 12 congruent rectangles (see diagram).



How big is the ratio  $\frac{AD}{DC}$ ?

- (A)  $\frac{8}{9}$       (B)  $\frac{5}{6}$       (C)  $\frac{7}{8}$       (D)  $\frac{2}{3}$       (E)  $\frac{9}{8}$

- 17.** A rabbit and a hedgehog enter a race against each other. The circular racecourse is 550 m long. The starting line and the finish line are the same. The speed of the rabbit is a constant 10 m/s, the speed of the hedgehog is a constant 1 m/s. They start at the same time, but the hedgehog tries to cheat by going in the opposite direction. When the two meet, the hedgehog turns around immediately and follows the rabbit. How many seconds after the rabbit does the hedgehog reach the finish line?

- (A) 45      (B) 50      (C) 55      (D) 100      (E) 505

- 18.** The grandchildren ask their grandma how old she is. The grandma invites them to guess the age. The first child says 75, the second says 78 and the third says 81. It turns out that one child is wrong by 1 year, one by 2 years and one by 4 years.

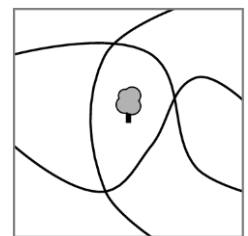
How many possibilities are there for the age of the grandma?

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

- 19.** There are three paths running through our park in the city (see diagram).

A tree is situated in the centre of the park.

What is the minimum number of trees that have to be planted additionally so that there are the same number of trees on either side of each path?

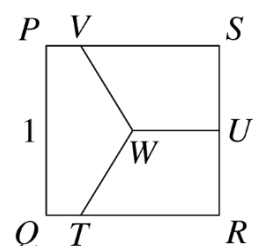


- (A) 1      (B) 2      (C) 3      (D) 4      (E) 5

- 20.** The diagram shows a square  $PQRS$  with side length 1. The point  $U$  is the midpoint of the side  $RS$  and the point  $W$  is the midpoint of the square.

The three line segments,  $TW$ ,  $UW$  and  $VW$  split the square into three equally big areas.

How long is the line segment  $SV$ ?



- (A)  $\frac{1}{2}$       (B)  $\frac{2}{3}$       (C)  $\frac{3}{4}$       (D)  $\frac{4}{5}$       (E)  $\frac{5}{6}$

**- 5 Point Examples -**

**21.** Once I met six sisters whose ages were six consecutive integers. I asked each one of them: How old is the oldest of your sisters?

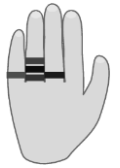
Which of the following numbers **cannot** be the sum of the six answers?

- (A) 95      (B) 125      (C) 167      (D) 205      (E) 233

**22.** Veronika wears five rings as shown.

How many, different ways are there for her to take off the rings one by one?

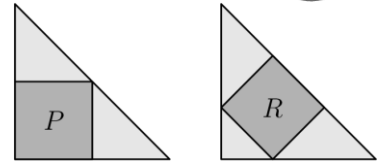
- (A) 16      (B) 20      (C) 24      (D) 30      (E) 45



**23.** One square is drawn inside each of the two congruent isosceles right-angled triangles. The area of square  $P$  is 45 units.

How many units is the area of square  $R$ ?

- (A) 35      (B) 40      (C) 45      (D) 50      (E) 60



**24.** In a certain city the inhabitants only communicate by asking questions. There are two kinds of inhabitants: the 'positive' that only ask questions that are answered with 'yes' and the 'negative' that only ask questions that are answered with 'no'. We meet the inhabitants Albert and Berta and Berta asks us: „Are Albert and I both negative?“

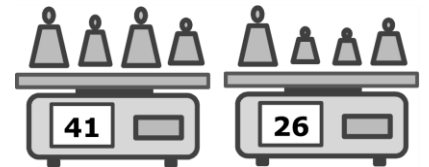
What kind of inhabitants are they?

- (A) Both are positive      (B) Both are negative  
 (C) Albert is positive and Berta is negative      (D) Albert is negative and Berta is positive  
 (E) There is not enough information to decide

**25.** Twelve weights have integer masses of 1 g, 2 g, 3 g, ..., 11 g and 12 g respectively. A vendor divides those weights up into 3 groups of 4 weights each. The total mass of the first group is 41 g, the mass of the second group is 26 g (see diagram).

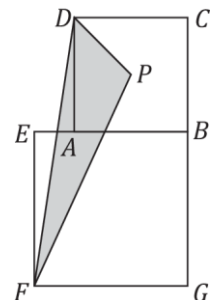
Which of the following weights is in the same group as the weight with 9 g?

- (A) 3 g      (B) 5 g      (C) 7 g      (D) 8 g      (E) 10 g



**26.** The diagonals of the squares  $ABCD$  and  $EFGB$  are 7 cm and 10 cm long respectively (see diagram). The point  $P$  is the point of intersection of the two diagonals of the square  $ABCD$ . How big is the area of the triangle  $FPD$  (in  $\text{cm}^2$ )?

- (A) 14.5      (B) 15      (C) 15.75      (D) 16.5      (E) 17.5



**27.** The product of the digits of a number  $N$  is 20.

Which of the following numbers **cannot** be the product of the digits of the number  $N + 1$ ?

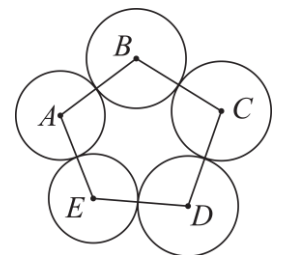
- (A) 24      (B) 25      (C) 30      (D) 35      (E) 40

**28.** Consider the five circles with midpoints  $A, B, C, D$  and  $E$  respectively, which touch each other as displayed in the diagram. The line segments, drawn in, connect the midpoints of adjacent circles.

The distances between the midpoints are  $AB = 16, BC = 14, CD = 17, DE = 13$  and  $AE = 14$ .

Which of the points is the midpoint of the circle with the biggest radius?

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



**29.** Eight teams take part in a football tournament where each team plays each other team exactly once. In each game the winner gets 3 points and the loser no points. In case of a draw both teams get 1 point. In the end all teams together have 61 points.

What is the maximum number of points that the team with the most points could have gained?

- (A) 21      (B) 19      (C) 18      (D) 17      (E) 16

**30.** A hemispheric hole is carved into each face of a wooden cube with sides of length 2. All holes are equally sized, and their midpoints are in the centre of the faces of the cube. The holes are as big as possible so that each hemisphere touches each adjacent hemisphere in exactly one point. How big is the diameter of the holes?

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

