

Känguru der Mathematik 2017

Level Junior (Grade 9 and 10)

Österreich – 16. 3. 2017



- 3 Points Questions -

1 The value of $\frac{20 \cdot 17}{2+0+1+7}$ equals

- (A) 3.4 (B) 17 (C) 34 (D) 201.7 (E) 340

2 Peter writes the word KANGAROO on a see-through piece of glass, as seen on the right. What can he see when he first flips over the glass onto its back along the right-hand side edge and then turns it about 180° while it is lying on the table?



- (A) (B) (C) (D) (E) (Note: The options in the image are visually identical to the original word but oriented upside down and mirrored.)

3 Angelika crafts a piece of jewellery out of two grey and two white stars. The stars have areas of 1 cm^2 , 4 cm^2 , 9 cm^2 and 16 cm^2 respectively. She places the stars on top of each other as shown in the diagram and glues them together.



How big is the total area of the visible grey parts?

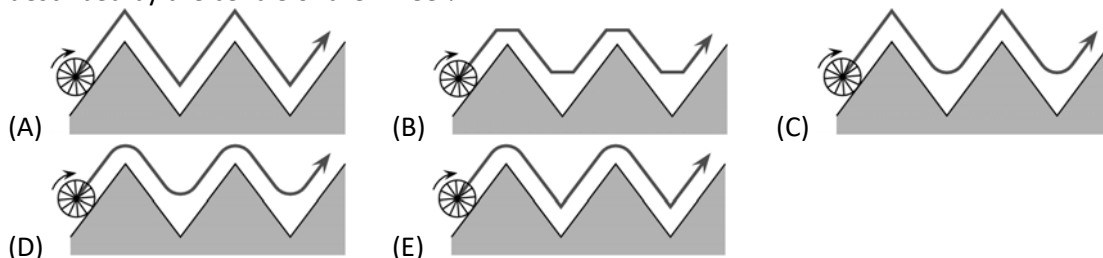
- (A) 9 cm^2 (B) 10 cm^2 (C) 11 cm^2 (D) 12 cm^2 (E) 13 cm^2

4 Maria has 24 Euros. Each of her 3 sisters has 12 Euros.

How much does she have to give to each sister so that all four of them have the same amount of Euros?

- (A) 1 (B) 2 (C) 3 (D) 4 (E) 6

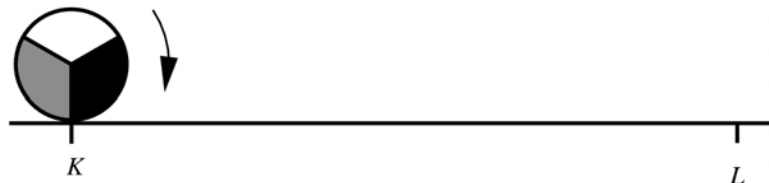
5 A wheel rolls along a zigzag curve as can be seen below. Which of the following pictures shows the curve that is described by the centre of the wheel?



6 Some girls are standing in a circle. The teacher makes them do a headcount. Bianca says one, her neighbour says two and so on. If they count in a clockwise direction, Antonia says six. If they count in an anticlockwise direction, Antonia says nine. How many girls are forming the circle?

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

7 A circle with radius 1 rolls along a straight line from point K to point L , as shown, with $KL = 11\pi$. In which position is the circle when it has arrived in L ?



- (A) (B) (C) (D) (E) (Note: The options show different orientations of the shaded sectors.)

8 Martina plays chess. This season she has already played 15 games, nine of which she has won. She still has to play 5 more games.

How high is her win rate at the end of the season if she wins all remaining games?

- (A) 60 % (B) 65 % (C) 70 % (D) 75 % (E) 80 %

9 At a wedding one eighth of the guests is underage. Three sevenths of the adult guests are men. How big is the fraction of adult women amongst all guests?

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

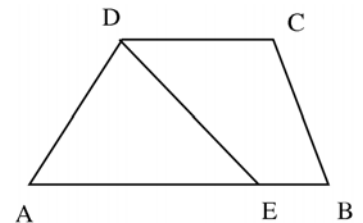
10 A whimsical teacher has a box with 203 red, 117 white and 28 blue buttons. He asks his students to each take one button out of the box without looking. What is the minimum number of students who have to take a button so that definitely at least three of the buttons picked have the same colour?

- (A) 3 (B) 6 (C) 7 (D) 28 (E) 203

- 4 Points Questions -

11 $ABCD$ is a trapezium with parallel sides AB and CD . Let $AB = 50$ and $CD = 20$. Point E lies on side AB in such a way that the straight line DE divides the trapezium into two shapes of equal area. How long is the straight line AE ?

- (A) 25 (B) 30 (C) 35 (D) 40 (E) 45



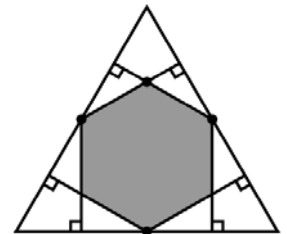
12 How many positive whole numbers n have the property that exactly one of the two numbers n and $n + 20$ has four digits?

- (A) 19 (B) 20 (C) 38 (D) 39 (E) 40

13 In an equilateral triangle with area 1, we draw the six perpendicular lines from the midpoints of each side to the other two sides as seen in the diagram.

How big is the area of the grey hexagon that has been created this way?

- (A) $\frac{1}{3}$ (B) $\frac{2}{5}$ (C) $\frac{4}{9}$ (D) $\frac{1}{2}$ (E) $\frac{2}{3}$

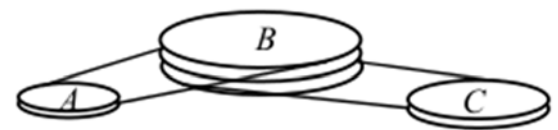


14 The sum of the squares of three consecutive positive whole numbers is 770. What is the biggest of these numbers?

- (A) 15 (B) 16 (C) 17 (D) 18 (E) 19

15 A belt system is made up of wheels A , B and C , which rotate without sliding. B rotates 4 times around, while A turns 5 times around, and B rotates 6 times around, while C turns 7 times around. The circumference of C is 30 cm. How big is the circumference of A ?

- (A) 27 cm (B) 28 cm (C) 29 cm (D) 30 cm (E) 31 cm



16 Tycho plans his running training. Each week he wants to go for a run on the same weekdays. He never wants to go for a run on two consecutive days. But he wants to go for a run three days a week. How many different weekly plans meet those conditions?

- (A) 6 (B) 7 (C) 9 (D) 10 (E) 35

17 Four brothers have different heights. Tobias is as many centimeters smaller than Viktor, as he is taller than Peter. Oskar on the other hand is equally many centimeters smaller than Peter. Tobias is 184 cm tall, and on average the four brothers are 178 cm tall. How tall is Oskar?

- (A) 160 cm (B) 166 cm (C) 172 cm (D) 184 cm (E) 190 cm

18 During our holidays it rained on 7 days. If it rained before noon, then there was no rain in the afternoon. If it rained in the afternoon, there was no rain before noon. There were 5 days without rain before noon and six days without rain in the afternoon. How many days long was our holiday?

- (A) 7 (B) 8 (C) 9 (D) 10 (E) 11

19 Jenny wants to write numbers into the cells of a 3×3 -table so that the sum of the numbers in each of the four 2×2 -squares are equally big. As it is shown in the diagram, she has already inserted three numbers. What number does she have to write into the cell in the fourth corner?

- (A) 5 (B) 4 (C) 1 (D) 0 (E) The number cannot be uniquely determined.

3		1
2		?

20 Seven positive whole numbers a, b, c, d, e, f, g are written down next to each other in this order. The sum of all seven numbers is 2017. Every two adjacent numbers always differ by 1. Which number can be equal to 286?

- (A) only a or g (B) only b or f (C) only c or e (D) only d (E) all

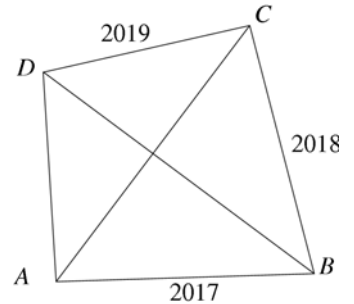
- 5 Points Questions -

21 In the primate enclosure in a zoo there are four gorillas. They are all younger than 18 years old. No two have the same age, and all their ages are whole numbers. The product of their ages is 882. How big is the sum of their ages?
 (A) 23 (B) 25 (C) 27 (D) 31 (E) 33

22 The numbers -3, -2, -1, 0, 1, 2 are written on the six faces of a die. The die is rolled twice. The numbers that were rolled are multiplied. How big is the probability that this product is negative?

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{11}{36}$ (D) $\frac{13}{36}$ (E) $\frac{1}{3}$

23 In a convex quadrilateral $ABCD$ the diagonals are perpendicular to each other. The length of the edges are $AB = 2017$, $BC = 2018$ and $CD = 2019$ (diagram not to scale). How long is side AD ?



(A) 2016 (B) 2018 (C) $\sqrt{2020^2 - 4}$ (D) $\sqrt{2018^2 + 2}$ (E) 2020

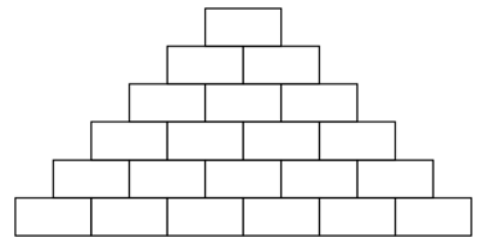
24 A popular two-digit number is made up of the digits a and b . If the number pair is written down three times one after the other, a six-digit number is obtained. This new number is always divisible by

(A) 2 (B) 5 (C) 7 (D) 9 (E) 11

25 My friend Heinz wants to use a special password that is made up of seven digits. Each digit used in the password appears as many times in the password as is the value of the digit. Additionally, equal digits are always next to each other. Therefore he can for example use 4444333 or 1666666 as passwords. How many possible passwords can he choose from?

(A) 6 (B) 7 (C) 10 (D) 12 (E) 13

26 Paul wants to write a positive whole number onto every tile in the number wall shown, so that every number is equal to the sum of the two numbers on the tiles that are directly below.



What is the maximum number of odd numbers he can write on the tiles?

(A) 13 (B) 14 (C) 15 (D) 16 (E) 17

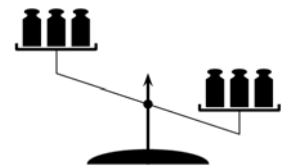
27 Lisa places some points on a circle and then connects them in sequence to make a polygon. She adds up the interior angles of the polygon. By mistake she misses out one angle and obtains the sum 2017. How big is the angle that she has overlooked?

(A) 37° (B) 53° (C) 97° (D) 127° (E) 143°

28 30 dancers are standing in a circle facing the centre. The dance instructor shouts "Left" and many of them turn 90° to the left. Unfortunately, some are confused and turn right, so that some dancers are now directly facing each other. All of the ones that are facing each other are shaking their head. It turns out that 10 dancers shake their head. Then the dance instructor says "Turn around" and all of them turn 180° to look in the opposite direction. Again, all of the ones that are directly facing each other shake their head. How many dancers are shaking their head second time round?

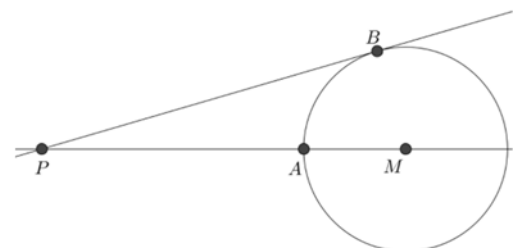
(A) 10 (B) 20 (C) 8 (D) 15 (E) It cannot be uniquely determined.

29 Three weights are randomly placed on each tray of a beam balance. The balance dips to the right hand side as shown on the picture. The masses of the weights are 101, 102, 103, 104, 105 and 106 grams. For how many percent of the possible distributions is the 106-grams-weight on the right (heavier) side?



(A) 75 % (B) 80 % (C) 90 % (D) 95 % (E) 100 %

30 The points A and B lie on a circle with centre M . The point P lies on the straight line through A and M . PB touches the circle in B . The lengths of the segments PA and MB are whole numbers, and $PB = PA + 6$. How many possible values for MB are there?



(A) 0 (B) 2 (C) 4 (D) 6 (E) 8