
Motivation and Creativity in Mathematical Problems

The Kangaroo Math Contest in Germany



About me

I mostly work on designing mathematical problems, getting pupils to work on them and teachers to use them, in particular

- annual Kangaroo Maths Contest
- digital mathematical advent calendars for primary schools
- mathematical “circles”
- problem design for other competitions
- organization of an international math camp for talented pupils, building networks with other people who design problems and think of beautiful mathematics



Common ideas of all activities

- popularization and promotion of mathematics and acknowledgment of its importance in general
- motivation to work on mathematical problems and to see the beauty and diversity of mathematics in particular, especially for those who are afraid of mathematics
- mathematics beyond “standard school mathematics”, special topics to learn more about the idea of mathematics, what it is good for and how and why mathematics works (creative thinking, problem solving, developing concepts versus application of learned algorithms), especially for those who are interested in mathematics



The Kangaroo Math Contest

The Kangaroo Contest has existed for more than 20 years, currently there are approximately 60 countries taking part with more than 6 million participants each year.

(Germany: approx. 850.000, Russia approx. 2 mio.)

Official website: <http://aksf.org>

Intention

- popularization of mathematics
- success for weak pupils, challenge for talented pupils
- mathematics for everybody,
be part of an international event



Content

- a set of interesting multiple-choice problems to be solved in 75 minutes, 24 problems for year 3/4 and 5/6, 30 problems for year 7/8, 9/10 and 11–13
- one out of five options is correct
- problems of increasing difficulty
- correct solution awarded 3, 4 or 5 points, false answers give negative points ($-\frac{1}{4}$ of the value)
- everybody is awarded a certificate, a small “prize for everybody” and a booklet, the most successful (5–6 %) receive prizes like board games, books, card games, experimental kits, invitations to math camps



The Problems

- focus on logic, strategy, planar and spatial sense, estimations, abstraction, creative thinking, clever ideas, reflection, recognition of patterns, connections between different things, properties, contradictions,...
- often contain unusual questions, surprising answers, known problems in new settings, interesting numbers, ..., that are embedded in little stories, either in everyday life of the children or in fictional stories, fairy tales, ...
- try to ask questions that naturally arise rather than being enforced
- transport joy doing mathematics, reduce fear, show that mathematics is diverse and everywhere in our live



Origin of the Problems, Design

In each country problems are designed that suit the purpose of the competition. They are collected and worked with at the annual meeting with the goal to select the respective number of problems for each group. Problems are polished, i. e. language is made proper English, pictures are made accurate, problems are checked if they are correct and contain all information needed.

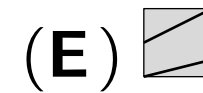
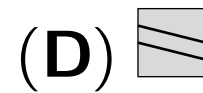
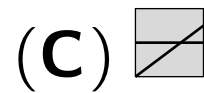
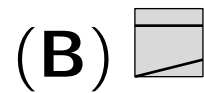
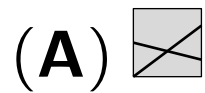
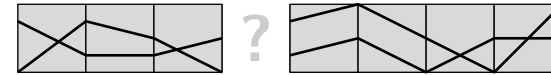
Each country then creates their own problem sets based on this selection. It is possible to exchange problems.

Difficulties: curricula, culture, language, taste...



Examples

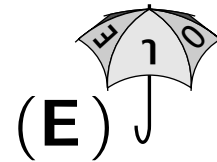
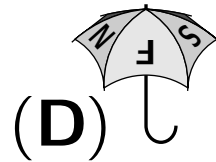
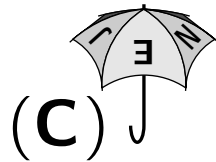
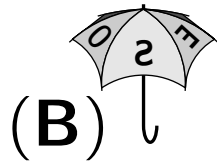
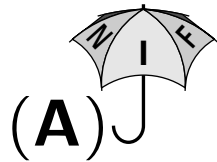
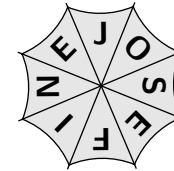
6. Which piece must be added to obtain two continuous lines?



(2014-3/4-6)



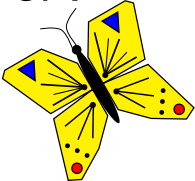
4. My umbrella has JOSEFINE written on top as shown in the diagram. One of the following pictures also shows my umbrella. Which one?



(2015-7/8-2)



1. Ein Schmetterling sitzt auf meiner richtig gelösten Hausaufgabe. Auf welcher Zahl sitzt er?

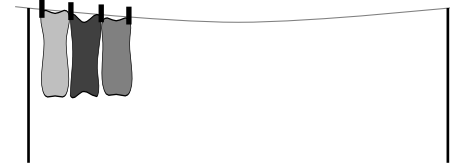
$$2005 - 205 = 1300 +$$


- (A) 250 (B) 400 (C) 500 (D) 910 (E) 1800

(2005-3/4-1)

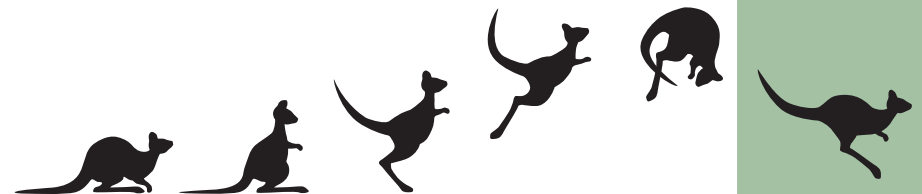


3. Today my dad did the laundry. To hang up the first 3 towels on the clothes line he needs 4 pegs. How many pegs in total will he need to hang up all 8 towels in this way?

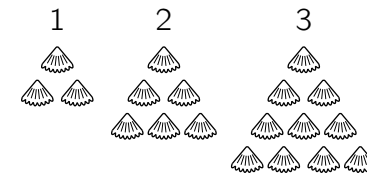


- (A) 4 (B) 7 (C) 9 (D) 11 (E) 16

(2012-3/4-3)



14. Janoš collected shells at the beach. At home he forms triangles with them. The first triangle contains 3 shells. For the next triangles he always adds a line of shells at the bottom. How many shells does Janoš need for the 6th triangle?



- (A) 28 (B) 27 (C) 25 (D) 24 (E) 21

(2014–3/4–13)



4. Tamara's new USB flash drive has a data storage space of 16 gigabytes. Her old one has only 4 gigabytes. 75 % of the new USB flash drive is used, 50 % of the old one is used. How many gigabytes of used storage space are there on both USB flash drives together?

- (A) 12 (B) 13 (C) 14 (D) 15 (E) 16

(2015–9/10–4)



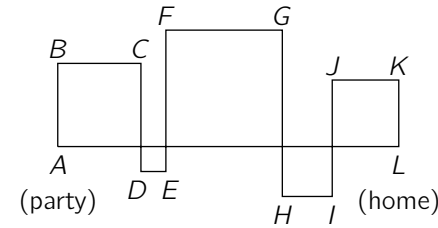
17. On our three day bike tour in the Netherlands we cycled from Sluis at the border to Belgium to Den Haag on the Euroroute R1. We spent the first night in Veere after one third of the total distance. On the second day we rode 75 km to Brielle. On the third day we cycled the last fourth of the total distance. What is the total distance we covered?

- (A) 150 km (B) 160 km (C) 165 km
(D) 175 km (E) 180 km

(2015-7/8-17)



18. At a party father hedgehog tried too many of the tasty fermented apples. Now he cannot find the straight way home. He staggers a bit, but as a hedgehog who loves mathematics always along the sides of squares. How much is his “square way” $ABCDEFGHIJKL$ longer than the straight way AL ?

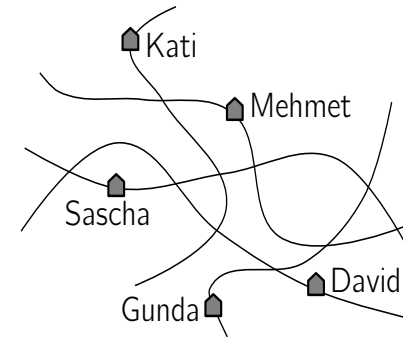


- (**A**) one and a half times (**B**) twice
 (**C**) two and a half times (**D**) three times
 (**E**) three and a half times

(2007–5/6–18)



19. On the bus Kay made a sketch of five streets in his neighbourhood. It can be seen that each of his friends lives at exactly one of the streets and that the five streets intersect in exactly 10 points. However, it cannot be seen instantly that four of these streets are actually straight lines. The fifth street is Curvy Alley. Who lives on Curvy Alley?



(A) David

(B) Gunda

(C) Kati

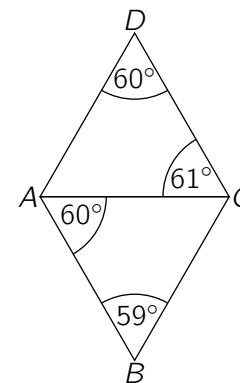
(D) Mehmet

(E) Sascha

(2011-9/10-19)



26. Johannes wanted to draw two equilateral triangles with one common side. When he measured the angles in his drawing he realized that his drawing is not exact. Not all angles are 60° , as shown in the figure. Which of the five segments in Johannes' drawing is the longest?



- (A) \overline{AD} (B) \overline{AC} (C) \overline{AB} (D) \overline{BC} (E) \overline{CD}

(2013–9/10–26)



25. Einst hatte ein Bäcker vom Müller mehrere Säcke Mehl geholt, ein jeder unterschiedlich schwer. Sein Geselle, der sich im Rechnen übte, fand, dass die beiden leichtesten Säcke 25 % der Gesamtmasse ausmachten. Die drei schwersten Säcke entsprachen 60 % der Gesamtmasse. Wie viele Säcke Mehl hatte der Bäcker vom Müller insgesamt geholt?

- (A) 6 (B) 7 (C) 8 (D) 9 (E) 10

(2015-7/8-25)



29. An antique set of scales is not working properly. If something is lighter than 1000 g, the scales show the correct weight, otherwise the scales can show any value greater than 1000 g. We have 5 weights A , B , C , D , E each under 1000 g. When they are weighed in pairs, the scale shows the following: $B + D = 1200$ g, $C + E = 2100$ g, $B + E = 800$ g, $B + C = 900$ g, $A + E = 700$ g.

Which of the weights is the heaviest?

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



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