

EUROPEAN 'KANGAROO' MATHEMATICAL CHALLENGE
'PINK'

Thursday 20th March 2014

Organised by the United Kingdom Mathematics Trust and the
Association Kangourou Sans Frontières

This competition is being taken by 6 million students in over 50 countries worldwide.

RULES AND GUIDELINES (to be read before starting):

1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England and Wales must be in School Year 10 or 11.
Candidates in Scotland must be in S3 or S4.
Candidates in Northern Ireland must be in School Year 11 or 12.
5. **Use B or HB pencil only**. For each question, mark *at most one* of the options A, B, C, D, E on the Answer Sheet. Do not mark more than one option.
6. Five marks will be awarded for each correct answer to Questions 1 - 15.
Six marks will be awarded for each correct answer to Questions 16 - 25.
7. *Do not expect to finish the whole paper in 1 hour*. Concentrate first on Questions 1-15.
When you have checked your answers to these, have a go at some of the later questions.
8. The questions on this paper challenge you **to think**, not to guess. You get more marks, and more satisfaction, by doing one question carefully than by guessing lots of answers.

*Enquiries about the European Kangaroo should be sent to: Maths Challenges Office,
School of Mathematics Satellite, University of Leeds, Leeds, LS2 9JT.*

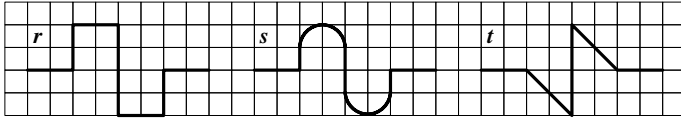
(Tel. 0113 343 2339)

<http://www.ukmt.org.uk>

1. The MSC Fabiola holds the record for being the largest container ship to enter San Francisco Bay. It carries 12 500 containers which, if placed end to end, would stretch about 75 km. Roughly, what is the length of one container?

A 0.6 m B 1.6 m C 6 m D 16 m E 60 m

2. If r , s , and t denote the lengths of the 'lines' in the picture, then which of the following inequalities is correct?



A $r < s < t$ B $r < t < s$ C $s < r < t$ D $s < t < r$ E $t < s < r$

3. Which of the following is halfway between $\frac{2}{3}$ and $\frac{4}{5}$?

A $\frac{11}{15}$ B $\frac{7}{8}$ C $\frac{3}{4}$ D $\frac{6}{15}$ E $\frac{5}{8}$

4. In the number 2014 the last digit is larger than the sum of the other three digits. How many years ago was this last true for the calendar year?

A 1 B 3 C 5 D 7 E 11

5. In a certain village, the ratio between adult men and adult women is 2 : 3 and the ratio between adult women and children is 8 : 1. What is the ratio between adults (men and women) and children?

A 5 : 1 B 10 : 3 C 13 : 1 D 12 : 1 E 40 : 3

6. The big wheel of this penny-farthing bicycle has perimeter 4.2 metres. The small wheel has perimeter 0.9 metres. At a certain moment, the valves of both wheels are at their lowest points. The bicycle begins to roll.

How many metres will the bicycle have rolled forward when both valves are next at their lowest points at the same time?



A 4.2 B 6.3 C 12.6 D 25.2 E 37.8

7. Doris, her daughter and granddaughter were all born in the month of January. Today their ages are all powers of 2. Moreover, the sum of their ages is 100. In which year was the granddaughter born?

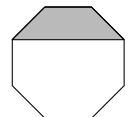
A 1998 B 2006 C 2010 D 2012 E 2013

8. Six girls share a flat which has two bathrooms. Every morning, beginning at 7:00, they use the bathrooms (one girl at a time per bathroom!). As soon as the last girl has finished, they sit down to eat breakfast together. The times they spend in the bathroom are 9, 11, 13, 18, 22, and 23 minutes. If they organise themselves well, what is the earliest they can have breakfast together?

A 7:48 B 7:49 C 7:50 D 7:51 E 8:03

9. The diagram shows a regular octagon, with a line drawn between two of its vertices. The shaded area measures 3 cm².

What is the area of the octagon in square centimetres?



A 9 B 10 C $8\sqrt{2}$ D 12 E $8 + 4\sqrt{2}$

10. The length of my crocodile's tail is a third of its entire length. Its head is 93 cm long and this is a quarter of the crocodile's length (not counting the tail).

How long is my crocodile in centimetres?

- A 558 B 496 C 490 D 372 E 186

11. The diagram shows a special die. Each pair of numbers on opposite faces has the same sum. The numbers on the hidden faces are all prime numbers. Which number is opposite to the 14 shown?



- A 11 B 13 C 17 D 19 E 23

12. After walking 8 km at a speed of 4 km/h, Ann starts to run at a speed of 8 km/h. For how many minutes will she have to run in order to have an average speed of 5 km/h over her complete journey?

- A 15 B 20 C 30 D 35 E 40

13. Cleo played 40 games of chess and scored 25 points. (A win counts as one point, a draw counts as half a point, and a loss counts as zero points.)

How many more games did she win than lose?

- A 5 B 7 C 10 D 12 E 15

14. Triplets Jane, Danielle and Hannah wanted to buy identical hats. However, Jane lacked a third of their price, Danielle a quarter and Hannah a fifth. When the price of each hat was reduced by €9.40, the sisters combined their savings and bought a hat each. Not a cent was left over! What was the price of a hat before the price reduction?

- A €12 B €16 C €28 D €36 E €112

15. Let p, q, r be positive integers such that

$$p + \frac{1}{q + \frac{1}{r}} = \frac{25}{19}.$$

Which of the following is equal to pqr ?

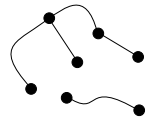
- A 6 B 10 C 18 D 36 E 42

16. In the equation $N \times U \times (M + B + E + R) = 33$, each letter stands for a different digit (0, 1, 2, ..., 9).

How many different ways are there to choose the values of the letters?

- A 12 B 24 C 30 D 48 E 60

17. The picture shows seven points and the connections between them. What is the least number of connecting lines that could be added to the picture so that each of the seven points has the same number of connections with other points? (Connecting lines are allowed to cross each other.)



- A 4 B 5 C 6 D 9 E 10

18. The picture shows the same cube from two different views. It is built from 27 smaller cubes, some of which are grey and some white. What is the largest number of grey cubes there could be?



- A 5 B 7 C 8 D 9 E 10



19. In a certain forest, frogs are either green or blue. Since last year, the number of blue frogs has increased by 60%, while the number of green frogs has decreased by 60%. It turns out that the new ratio of blue frogs to green frogs is the same as the previous ratio in the opposite order (i.e. the same as the previous ratio of green frogs to blue frogs).
By what percentage did the overall number of frogs change?

A 0 B 20 C 30 D 40 E 50

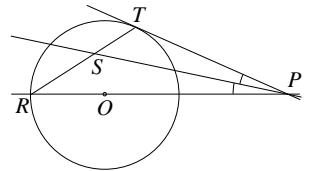
20. Tomas wrote down several distinct positive integers, none of which exceeded 100. Their product was not divisible by 18.
At most how many numbers could he have written?

A 5 B 17 C 68 D 69 E 90

21. Any three vertices of a given cube form the vertices of a triangle.
What is the number of triangles formed in this way whose three vertices are not all in the same face of the cube?

A 16 B 24 C 32 D 40 E 48

22. In the picture, PT is a tangent to the circle with centre O and PS is the angle bisector of angle RPT .
What is the size of angle TSP ?



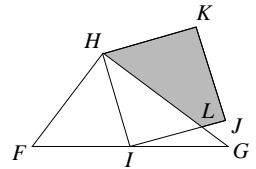
A 30° B 45° C 50° D 60°
E It depends on the position of point P .

23. Tatiana wrote down in ascending order the list of all 7-digit numbers that contain each of the digits 1, 2, 3, . . . , 7. She then split the list exactly at the middle into two parts of the same size.

What is the largest number in the first half?

A 1 234 567 B 3 765 421 C 4 123 567 D 4 352 617 E 4 376 521

24. The diagram shows a triangle FHG with $FH = 6$, $GH = 8$ and $FG = 10$. The point I is the midpoint of FG , and $HIJK$ is a square. The line segment IJ intersects GH at L .



What is the area of the shaded quadrilateral $HLJK$?

A $\frac{124}{8}$ B $\frac{125}{8}$ C $\frac{126}{8}$ D $\frac{127}{8}$ E $\frac{128}{8}$

25. A magical island is inhabited entirely by knights (who always tell the truth) and knaves (who always tell lies). One day 2014 of the islanders were standing in a long queue. Each person in the queue said, "There are more knaves behind me than knights in front of me".

How many knights were in the queue?

A 1 B 504 C 1007 D 1008 E 2014