

**EUROPEAN 'KANGAROO' MATHEMATICAL CHALLENGE  
'GREY'**

**Thursday 15th March 2018**

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

*This competition is being taken by 6 million students in over 60 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 9 or below.  
Candidates in Scotland must be in S2 or below.  
Candidates in Northern Ireland must be in School Year 10 or below.
5. **Use B or HB non-propelling 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. Though you will not lose marks for getting answers wrong, you will undoubtedly get more marks, and more satisfaction, by doing a few questions carefully than by guessing lots of answers.

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

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1. What is the value of  $\frac{2018 + 2018 + 2018}{2018 + 2018 + 2018 + 2018}$ ?

- A  $\frac{1}{2018}$       B 1      C 0.2018      D -2018      E  $\frac{3}{4}$

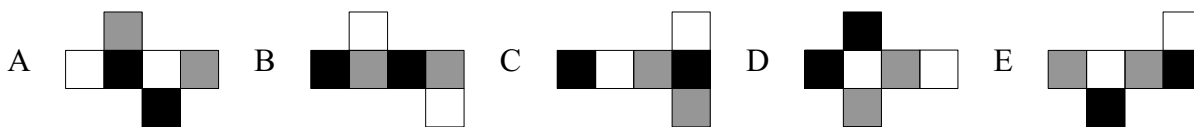
2. When the letters of the word **MAMA** are written vertically above one another the word has a vertical line of symmetry.



Which of these words also has a vertical line of symmetry when written in the same way?

- A **ROOT**    B **BOOM**    C **BOOT**    D **LOOT**    E **TOOT**

3. The faces of a cube are painted black, white or grey. Each face is only painted one colour and opposite faces are painted the same colour. Which of the following is a possible net for the cube?



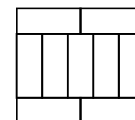
4. Which number should replace the symbol \* in the equation  $2 \times 18 \times 14 = 6 \times * \times 7$  to make it correct?

- A 8      B 9      C 10      D 12      E 15

5. The two numbers  $a$  and  $b$  both lie between  $-5$  and  $10$  inclusive. What is the largest possible value of  $a - b$ ?

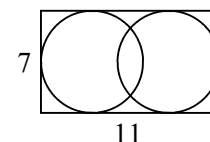
- A  $-5$       B 0      C 10      D 15      E 20

6. The large rectangle shown is made up of nine identical rectangles whose longest sides are 10 cm long. What is the perimeter of the large rectangle?



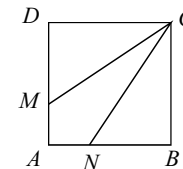
- A 40 cm    B 48 cm    C 76 cm    D 81 cm    E 90 cm

7. The diagram shows a rectangle of size 7 cm  $\times$  11 cm containing two circles that each touch three of the sides of the rectangle. What is the distance between the centres of the two circles?



- A 2 cm    B 2.5 cm    C 3 cm    D 3.5 cm    E 4 cm

8. Square  $ABCD$  has sides of length 3 cm. The points  $M$  and  $N$  lie on  $AD$  and  $AB$  so that  $CM$  and  $CN$  split the square into three pieces of the same area. What is the length of  $DM$ ?



- A 0.5 cm    B 1 cm    C 1.5 cm    D 2 cm    E 2.5 cm

9. Martha multiplied two 2-digit numbers correctly on a piece of paper. Then she scribbled out three digits as shown. What is the sum of the three digits she scribbled out?



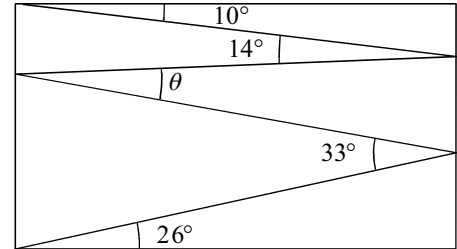
- A 5      B 6      C 9      D 12      E 14

10. A rectangle is divided into 40 identical squares. The rectangle contains more than one row of squares. Andrew coloured all the squares in the middle row. How many squares did he not colour?

- A 20      B 30      C 32      D 35      E 39

11. A lion is hidden in one of three rooms. A note on the door of room 1 reads “The lion is here”. A note on the door of room 2 reads “The lion is not here”. A note on the door of room 3 reads “ $2 + 3 = 2 \times 3$ ”. Only one of these notes is true. In which room is the lion hidden?
- A In room 1.    B In room 2.    C In room 3.    D It may be in any room.  
E It may be in either room 1 or room 2.

12. Valeriu draws a zig-zag line inside a rectangle, creating angles of  $10^\circ$ ,  $14^\circ$ ,  $33^\circ$  and  $26^\circ$  as shown. What is the size of the angle marked  $\theta$ ?



- A  $11^\circ$     B  $12^\circ$     C  $16^\circ$     D  $17^\circ$     E  $33^\circ$

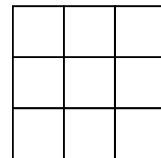
13. Alice wants to write down a list of prime numbers less than 100, using each of the digits 1, 2, 3, 4 and 5 once and no other digits. Which prime number must be in her list?

- A 2                      B 5                      C 31                      D 41                      E 53

14. A hotel on an island in the Caribbean advertises using the slogan ‘350 days of sun every year!’ According to the advert, what is the smallest number of days Will Burn has to stay at the hotel in 2018 to be certain of having two consecutive days of sun?

- A 17                      B 21                      C 31                      D 32                      E 35

15. James wrote a different integer from 1 to 9 in each cell of a table. He then calculated the sum of the integers in each of the rows and in each of the columns of the table. Five of his answers were 12, 13, 15, 16 and 17, in some order. What was his sixth answer?



- A 17    B 16    C 15    D 14    E 13

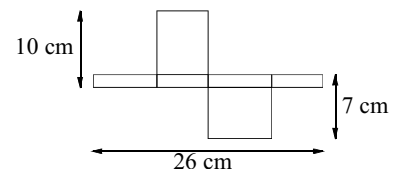
16. Eleven points are marked from left to right on a straight line. The sum of all the distances between the first point and the other points is 2018 cm. The sum of all the distances between the second point and the other points, including the first one, is 2000 cm. What is the distance between the first and second points?

- A 1 cm                      B 2 cm                      C 3 cm                      D 4 cm                      E 5 cm

17. There are three candidates standing for one position as student president and 130 students are voting. Sally has 24 votes so far, while Katie has 29 and Alan has 37. How many more votes does Alan need to be certain he will finish with the most votes?

- A 13                      B 14                      C 15                      D 16                      E 17

18. The diagram shows a net of an unfolded rectangular box. What is the volume of the box (in  $\text{cm}^3$ )?

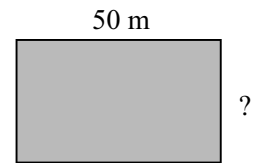


- A 43    B 70    C 80    D 100    E 1820

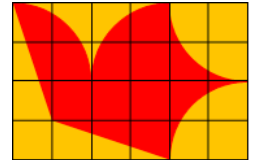
19. Amy, Becky and Chloe went shopping. Becky spent only 15 % of what Chloe spent. However, Amy spent 60 % more than Chloe. Together they spent £55. How much did Amy spend?

- A £3                      B £20                      C £25                      D £26                      E £32

20. Ruth and Sarah decide to have a race. Ruth runs around the perimeter of the pool shown in the diagram while Sarah swims lengths of the pool. Ruth runs three times as fast as Sarah swims. Sarah swims six lengths of the pool in the same time Ruth runs around the pool five times. How wide is the pool?



- A 25 m                  B 40 m                  C 50 m                  D 80 m                  E 180 m
21. Freda's flying club designed a flag of a flying dove on a square grid as shown.



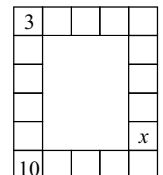
- The area of the dove is  $192 \text{ cm}^2$ . All parts of the perimeter of the dove are either quarter-circles or straight lines. What are the dimensions of the flag?

- A  $6 \text{ cm} \times 4 \text{ cm}$                   B  $12 \text{ cm} \times 8 \text{ cm}$                   C  $21 \text{ cm} \times 14 \text{ cm}$   
D  $24 \text{ cm} \times 16 \text{ cm}$                   E  $27 \text{ cm} \times 18 \text{ cm}$
22. Dominoes are said to be arranged *correctly* if, for each pair of adjacent dominoes, the numbers of spots on the adjacent ends are equal. Paul laid six dominoes in a line as shown in the diagram.



He can make a move either by swapping the position of any two dominoes (without rotating either domino) or by rotating one domino. What is the smallest number of moves he needs to make to arrange all the dominoes correctly?

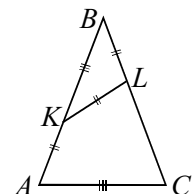
- A 1                  B 2                  C 3                  D 4                  E 5
23. Wendy wants to write a number in every cell on the border of a table. In each cell, the number she writes is equal to the sum of the two numbers in the cells with which this cell shares an edge. Two of the numbers are given in the diagram.



What number should she write in the cell marked  $x$ ?

- A 10                  B 7                  C 13                  D  $-13$                   E  $-3$
24. Viola has been practising the long jump. At one point, the average distance she had jumped was 3.80 m. Her next jump was 3.99 m and that increased her average to 3.81 m. After the following jump, her average had become 3.82 m. How long was her final jump?

- A 3.97 m                  B 4.00 m                  C 4.01 m                  D 4.03 m                  E 4.04 m
25. In the isosceles triangle  $ABC$ , points  $K$  and  $L$  are marked on the equal sides  $AB$  and  $BC$  respectively so that  $AK = KL = LB$  and  $KB = AC$ . What is the size of angle  $ABC$ ?



- A  $36^\circ$                   B  $38^\circ$                   C  $40^\circ$                   D  $42^\circ$                   E  $44^\circ$