EUROPEAN 'KANGAROO' MATHEMATICAL CHALLENGE
'GREY'
Thursday 16th March 2017

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.

Enquiries about the European Kangaroo should be sent to:
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(Tel. 0113 343 2339)
http://www.ukmt.org.uk

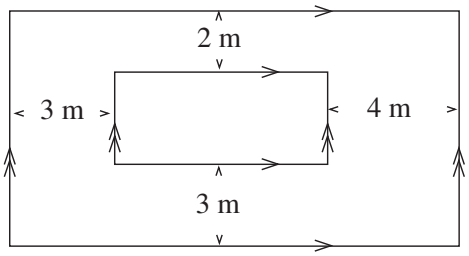
1. A group of girls stands in a circle. Florence is the fourth on the left from Jess and the seventh on the right from Jess. How many girls are in the group?

A 9 B 10 C 11 D 12 E 13

2. Which of the following equalities is true?

A $\frac{4}{1} = 1.4$ B $\frac{5}{2} = 2.5$ C $\frac{6}{3} = 3.6$ D $\frac{7}{4} = 4.7$ E $\frac{8}{5} = 5.8$

3. The diagram shows two rectangles whose corresponding sides are parallel as shown. What is the difference between the lengths of the perimeters of the two rectangles?



A 12 m B 16 m C 20 m
D 22 m E 24 m

4. The sum of three different positive integers is 7. What is the product of these three integers?

A 12 B 10 C 9 D 8 E 5

5. The diagram shows four overlapping hearts. The areas of the hearts are 1 cm^2, 4 cm^2, 9 cm^2 and 16 cm^2. What is the total shaded area?

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

6. What time is it 2017 minutes after 20:17?

A 05:54 B 09:54 C 16:34 D 20:34 E 23:34

7. Olivia has 20 euros. Each of her four sisters has 10 euros. How many euros does Olivia need to give to each of her sisters so that each of the five girls has the same amount of money?

A 2 B 4 C 5 D 8 E 10

8. Adam the Ant started at the left-hand end of a pole and crawled $\frac{2}{3}$ of its length. Benny the Beetle started at the right-hand end of the same pole and crawled $\frac{3}{4}$ of its length. What fraction of the length of the pole are Adam and Benny now apart?

A $\frac{3}{8}$ B $\frac{1}{12}$ C $\frac{5}{7}$ D $\frac{1}{2}$ E $\frac{5}{12}$

9. Four cousins Alan, Bob, Carl and Dan are 3, 8, 12 and 14 years old, although not necessarily in that order. Alan is younger than Carl. The sum of the ages of Alan and Dan is divisible by 5. The sum of the ages of Carl and Dan is divisible by 5. What is the sum of the ages of Alan and Bob?

A 26 B 22 C 17 D 15 E 11

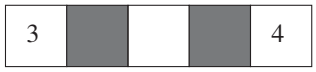
10. One sixth of an audience in a children's theatre are adults. Two fifths of the children are boys. What fraction of the audience are girls?

A $\frac{1}{2}$ B $\frac{1}{3}$ C $\frac{1}{4}$ D $\frac{1}{5}$ E $\frac{2}{5}$

11. This year there were more than 800 entrants in the Kangaroo Hop race. Exactly 35% of the entrants were female and there were 252 more males than females. How many entrants were there in total?

A 802 B 810 C 822 D 824 E 840

12. Ellie wants to write a number in each box of the diagram shown. She has already written in two of the numbers. She wants the sum of all the numbers to be 35, the sum of the numbers in the first three boxes to be 22, and the sum of the numbers in the last three boxes to be 25.



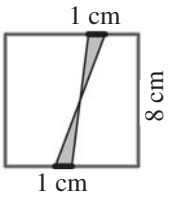
What is the product of the numbers she writes in the shaded boxes?

A 0 B 39 C 48 D 63 E 108

13. Rohan wants to cut a piece of string into nine pieces of equal length. He marks his cutting points on the string. Jai wants to cut the same piece of string into only eight pieces of equal length. He marks his cutting points on the string. Yuvraj then cuts the string at all the cutting points that are marked. How many pieces of string does Yuvraj obtain?

A 15 B 16 C 17 D 18 E 19

14. Two segments, each 1 cm long, are marked on opposite sides of a square of side 8 cm. The ends of the segments are joined as shown in the diagram. What is the total shaded area?

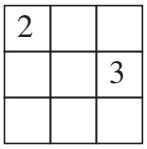


A 2 cm^2 B 4 cm^2 C 6.4 cm^2 D 8 cm^2 E 10 cm^2

15. Margot wants to prepare a jogging timetable. She wants to jog exactly twice a week, and on the same days every week. She does not want to jog on two consecutive days. How many different timetables could Margot prepare?

A 18 B 16 C 14 D 12 E 10

16. Ella wants to write a number into each cell of a 3 × 3 grid so that the sum of the numbers in any two cells that share an edge is the same. She has already written two numbers, as shown in the diagram.



When Ella has completed the grid, what will be the sum of all the numbers in the grid?

A 18 B 20 C 21 D 22 E 23

17. Tom has a list of nine integers: 1, 2, 3, 4, 5, 6, 7, 8 and 9. He creates a second list by adding 2 to some of the integers in the first list and by adding 5 to all of the other integers in the first list. What is the smallest number of different integers he can obtain in the second list?

A 5 B 6 C 7 D 8 E 9

18. Ten kangaroos stood in a line as shown in the diagram.

At a particular moment, two kangaroos standing nose-to-nose exchanged places by jumping past each other. Each of the two kangaroos involved in an exchange continued to face the same way as it did before the exchange. This was repeated until no further exchanges were possible. How many exchanges were made?

A 15 B 16 C 18 D 20 E 21

19. Buses leave the airport every 3 minutes to travel to the city centre. A car leaves the airport at the same time as one bus and travels to the city centre by the same route. It takes each bus 60 minutes and the car 35 minutes to travel from the airport to the city centre. How many of these airport buses does the car overtake on its way to the city centre, excluding the bus it left with?

A 8 B 9 C 10 D 11 E 13

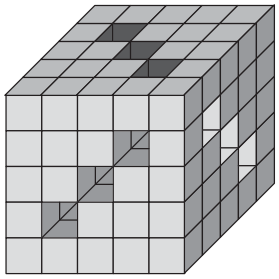
20. Anastasia's tablecloth has a regular pattern, as shown in the diagram. What percentage of her tablecloth is black?

A 16 B 24 C 25 D 32 E 36

21. Each number in the sequence starting 2, 3, 6, 8, 8, 4, ... is obtained in the following way. The first two numbers are 2 and 3 and afterwards each number is the last digit of the product of the two preceding numbers in the sequence. What is the 2017th number in the sequence?

A 8 B 6 C 4 D 3 E 2

22. Stan had 125 small cubes. He glued some of them together to form a large cube with nine tunnels, each perpendicular to two opposite faces and passing through the cube, as shown in the diagram.



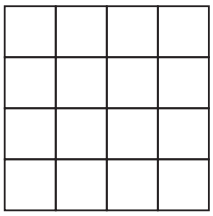
How many of the small cubes did he not use?

A 52 B 45 C 42 D 39 E 36

23. Eric and Eleanor are training on a 720 metre circular track. They run in opposite directions, each at a constant speed. Eric takes four minutes to complete the full circuit and Eleanor takes five minutes. How far does Eleanor run between consecutive meetings of the two runners?

A 355 m B 350 m C 340 m D 330 m E 320 m

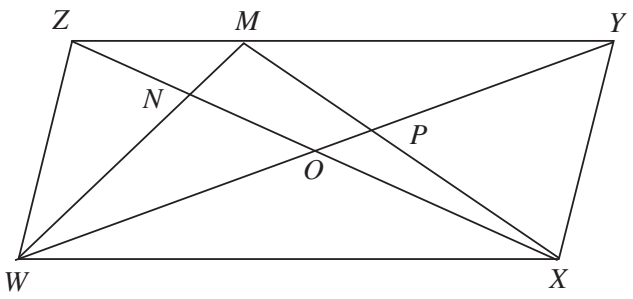
24. Ellen wants to colour some of the cells of a 4×4 grid. She wants to do this so that each coloured cell shares at least one side with an uncoloured cell and each uncoloured cell shares at least one side with a coloured cell.



What is the largest number of cells she can colour?

A 12 B 11 C 10 D 9 E 8

25. The diagram shows a parallelogram $WXYZ$ with area S. The diagonals of the parallelogram meet at the point O. The point M is on the edge ZY. The lines WM and ZX meet at N. The lines MX and WY meet at P. The sum of the areas of triangles WNZ and XYP is $\frac{1}{3}S$. What is the area of quadrilateral $MNOP$?



A $\frac{1}{6}S$ B $\frac{1}{8}S$ C $\frac{1}{10}S$ D $\frac{1}{12}S$ E $\frac{1}{14}S$