EUROPEAN 'KANGAROO' MATHEMATICAL CHALLENGE
'GREY'
Thursday 19th March 2015

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:
UKMT, School of Mathematics, University of Leeds, Leeds, LS2 9JT.
(Tel. 0113 343 2339)
http://www.ukmt.org.uk

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

A 

B 

C 

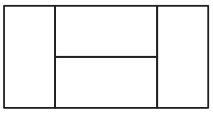
D 

E 

2. Which of the following numbers is closest to 2.015×510.2?

A 0.1 B 1 C 10 D 100 E 1000

3. Four identical small rectangles are put together to form a large rectangle as shown. The length of a shorter side of each small rectangle is 10 cm. What is the length of a longer side of the large rectangle?



A 50 cm B 40 cm C 30 cm D 20 cm E 10 cm

4. Which of the following numbers is not an integer?

A $\frac{2011}{1}$ B $\frac{2012}{2}$ C $\frac{2013}{3}$ D $\frac{2014}{4}$ E $\frac{2015}{5}$

5. A triangle has sides of lengths 6 cm, 10 cm and 11 cm. An equilateral triangle has the same perimeter. What is the length of the sides of the equilateral triangle?

A 18 cm B 11 cm C 10 cm D 9 cm E 6 cm

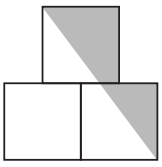
6. A cyclist rides at 5 metres per second. The wheels of his bicycle have a circumference of 125 cm. How many complete turns does each wheel make in 5 seconds?

A 4 B 5 C 10 D 20 E 25

7. In a class, no two boys were born on the same day of the week and no two girls were born in the same month. Were another child to join the class, this would no longer be true. How many children are there in the class?

A 18 B 19 C 20 D 24 E 25

8. In the diagram, the centre of the top square is directly above the common edge of the lower two squares. Each square has sides of length 1 cm. What is the area of the shaded region?



A $\frac{3}{4}$ cm^2 B $\frac{7}{8}$ cm^2 C 1 cm^2 D $1\frac{1}{4}$ cm^2 E $1\frac{1}{2}$ cm^2

9. Every asterisk in the equation $2 * 0 * 1 * 5 * 2 * 0 * 1 * 5 * 2 * 0 * 1 * 5 = 0$ is to be replaced with either + or − so that the equation is correct. What is the smallest number of asterisks that can be replaced with +?

A 1 B 2 C 3 D 4 E 5

10. During a rainstorm, 15 litres of water fell per square metre. By how much did the water level in Michael's outdoor pool rise?

A 150 cm B 0.15 cm C 15 cm D 1.5 cm E It depends upon the size of the pool

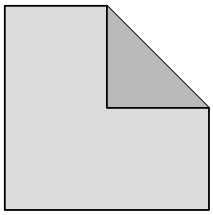
11. A bush has 10 branches. Each branch has either 5 leaves only or 2 leaves and 1 flower. Which of the following could be the total number of leaves the bush has?

A 45 B 39 C 37 D 31 E None of A to D

12. The mean score of the students who took a mathematics test was 6. Exactly 60% of the students passed the test. The mean score of the students who passed the test was 8. What was the mean score of the students who failed the test?

A 1 B 2 C 3 D 4 E 5

13. One corner of a square is folded to its centre to form an irregular pentagon as shown in the diagram. The area of the square is 1 unit greater than the area of the pentagon. What is the area of the square?

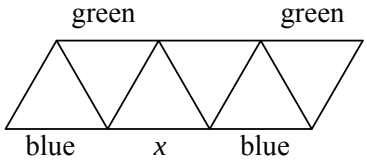


A 2 B 4 C 8 D 16 E 32

14. Rachel added the lengths of three sides of a rectangle and got 44 cm. Heather added the lengths of three sides of the same rectangle and got 40 cm. What is the perimeter of the rectangle?

A 42 cm B 56 cm C 64 cm D 84 cm E 112 cm

15. Luis wants to make a pattern by colouring the sides of the triangles shown in the diagram. He wants each triangle to have one red side, one green side and one blue side. Luis has already coloured some of the sides as shown. What colour can he use for the side marked x?

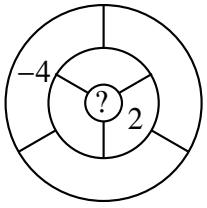


A only green B only blue C only red D either blue or red
E The task is impossible

16. Miss Spelling, the English teacher, asked five of her students how many of the five of them had done their homework the day before. Daniel said none, Ellen said only one, Cara said exactly two, Zain said exactly three and Marcus said exactly four. Miss Spelling knew that the students who had not done their homework were not telling the truth but those who had done their homework were telling the truth. How many of these students had done their homework the day before?

A 0 B 1 C 2 D 3 E 5

17. Ria wants to write a number in each of the seven bounded regions in the diagram. Two regions are neighbours if they share part of their boundary. The number in each region is to be the sum of the numbers in all of its neighbours. Ria has already written in two of the numbers, as shown.



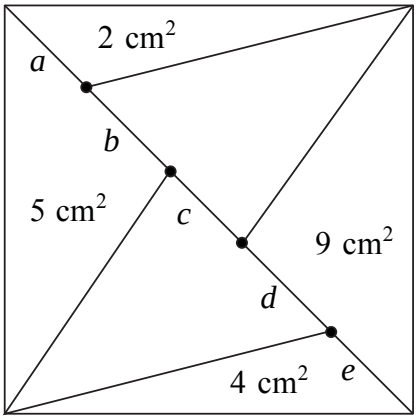
What number must she write in the central region?

A 0 B 1 C −2 D −4 E 6

18. Five positive integers (not necessarily all different) are written on five cards. Boris calculates the sum of the numbers on every pair of cards. He obtains only three different totals: 57, 70 and 83. What is the largest integer on any card?

A 35 B 42 C 48 D 53 E 82

19. A square with area 30 cm^2 is divided in two by a diagonal and then into triangles as shown.
The areas of some of these triangles are given in the diagram (which is not drawn to scale). Which part of the diagonal is the longest?

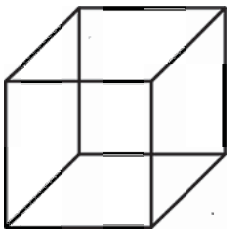


A *a* B *b* C *c* D *d* E *e*

20. In a mob of kangaroos, the two lightest kangaroos together weigh 25% of the total weight of the mob. The three heaviest kangaroos together weigh 60% of the total weight. How many kangaroos are in the mob?

A 6 B 7 C 8 D 15 E 20

21. Andrew has seven pieces of wire of lengths 1 cm, 2 cm, 3 cm, 4 cm, 5 cm, 6 cm and 7 cm. He bends some of the pieces to form a wire frame in the shape of a cube with edges of length 1 cm without any overlaps. What is the smallest number of these pieces that he can use?



A 1 B 2 C 3 D 4 E 5

22. In trapezium *PQRS*, the sides *PQ* and *SR* are parallel. Angle *RSP* is 120° and $PS = SR = \frac{1}{3}PQ$. What is the size of angle *PQR*?

A 15° B 22.5° C 25° D 30° E 45°

23. Five points lie on a straight line. Alex finds the distances between every pair of points. He obtains, in increasing order, 2, 5, 6, 8, 9, *k*, 15, 17, 20 and 22. What is the value of *k*?

A 14 B 13 C 12 D 11 E 10

24. Gregor divides 2015 successively by 1, 2, 3, and so on up to and including 1000. He writes down the remainder for each division. What is the largest remainder he writes down?

A 55 B 215 C 671 D 1007 E some other value

25. Every positive integer is to be coloured according to the following three rules. (i) Each number is to be coloured either red or green. (ii) The sum of any two different red numbers is a red number. (iii) The sum of any two different green numbers is a green number. In how many different ways can this be done?

A 0 B 2 C 4 D 6 E more than 6