

**EUROPEAN 'KANGAROO' MATHEMATICAL CHALLENGE  
'PINK'**

**Thursday 24th April 2008**

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

*This paper is being taken by students in over thirty countries in Europe and beyond.*

**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. 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.

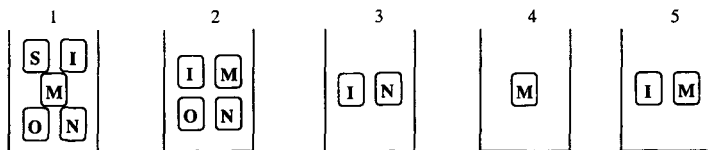
*Enquiries about the European Kangaroo should be sent to: Maths Challenges  
Office,*

*School of Mathematics, University of Leeds, Leeds, LS2 9JT.*

*(Tel. 0113 343 2339)*

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

1. Five boxes contain cards as shown. Simon removes cards so that each box contains exactly one card, and the five cards remaining in the boxes can be used to spell his name. Which card remains in box 2?



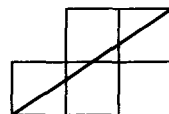
A S                      B I                      C M                      D O                      E N

2. Frank and Gabriel competed in a 200 m race. Gabriel finished in half a minute and Frank finished in one hundredth of an hour. Which of the following statements is true?

A Gabriel won by 36 seconds      B Frank won by 24 seconds  
C Gabriel won by 6 seconds      D Frank won by 6 seconds      E It was a dead-heat

3. Four unit squares are placed edge to edge as shown. What is the length of the line  $PQ$ ?

A 5      B  $\sqrt{13}$       C  $\sqrt{5} + \sqrt{2}$       D  $\sqrt{5}$       E 13



4. What is the smallest number of letters that need to be removed from the word DISCOVER so that the remaining letters are in alphabetical order?

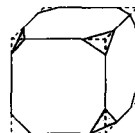
A 5                      B 4                      C 3                      D 2                      E 1

5. Tom and Jerry started with identical rectangular sheets of paper. Each of them cut his sheet into two. Tom obtained two rectangles, each with a perimeter of 40 cm while Jerry obtained two rectangles, each with a perimeter of 50 cm. What was the perimeter of Tom's original sheet of paper?

A 40 cm      B 50 cm      C 60 cm      D 80 cm      E 90 cm

6. A shape is made by cutting all the corners off a cube, as shown in the diagram. How many edges does the shape have?

A 24      B 30      C 36      D 42      E 48



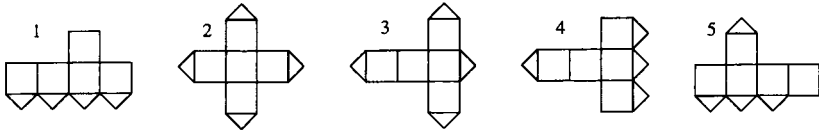
7. In Emily's first spelling test of this new term, she scored one mark out of five so she decided to work really hard to improve her scores. Assuming that she succeeds in scoring full marks (five out of five) in all her tests after the first, how many more tests does she need to take to increase her average to four out of five?

A 2                      B 3                      C 4                      D 5                      E 6

8. Gar the Magician wrote each of the numbers from 1 to 7, one on each of seven cards and placed them in his hat. He offered the hat to two other magicians, Kan and Roo. Kan took, at random, 3 cards from the hat and Roo took 2 cards (so that there were 2 cards left in the hat). Kan told Roo: "I can deduce that the sum of the numbers on your cards is even". What was the sum of the numbers on Kan's cards?

A 6                      B 9                      C 10                      D 12                      E 15

9. One face of a cardboard cube is cut along its diagonals, as shown.  
Which of the following are **not** nets for this cube?



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

10. The Seven Dwarfs were born on the same day, in seven consecutive years. The ages of the youngest three add up to 42 years. What do the ages of the oldest three add up to?

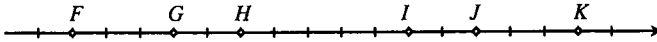
- A 48      B 51      C 54      D 60      E 70

11. A parallelogram contains two identical regular hexagons. The hexagons share a common side, and each has two sides touching the sides of the parallelogram. What fraction of the parallelogram's area is shaded?



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

12. On the number line, each gap equals one unit. Six integers are marked as shown. At least two of the integers are divisible by 3, and at least two of them are divisible by 5. Which of the integers are divisible by 15?

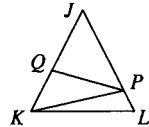


- A  $F$  and  $K$       B  $G$  and  $J$       C  $H$  and  $I$       D all six numbers      E only one of them

13. Dominique wrote down the 1000-digit number 20082008...2008. She erased some digits and was surprised to find that the remaining digits added up to 2008. What is the largest number of digits that she could have erased?

- A 251      B 500      C 502      D 746      E 749

14. In the diagram, triangle  $JKL$  is isosceles with  $JK = JL$ ,  $PQ$  is perpendicular to  $JK$ , angle  $KPL$  is  $120^\circ$  and angle  $JKP$  is  $50^\circ$ . What is the size of angle  $PKL$ ?



- A  $5^\circ$       B  $10^\circ$       C  $15^\circ$       D  $20^\circ$       E  $25^\circ$

15. How many pairs of numbers  $(a, b)$  exist such that the sum  $a + b$ , the product  $ab$  and the quotient  $\frac{a}{b}$  of these two numbers are all equal?

- A 0      B 1      C 2      D 4      E 8

16. Jane wants to create a six-digit number for her padlock. She writes down two digits and each digit she writes after these is the sum of the previous two digits. How many six-digit numbers could she create in this way? (A number may not start with the digit zero.)

- A 0      B 1      C 2      D 4      E 6

17. For a positive integer  $n$ , we define  $n!$  to be the product of all the positive integers from 1 to  $n$ ; that is  $n! = 1 \times 2 \times 3 \times \dots \times n$ . If  $n! = 2^{15} \times 3^6 \times 5^3 \times 7^2 \times 11 \times 13$ , what is the value of  $n$ ?

- A 13      B 14      C 15      D 16      E 17

