



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

**Thursday 17th March 2005**

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

*This paper is being taken by students in twenty-nine European countries.*

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

*(Tel. 0113 343 2339)*

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

1. Helga lives with her father, mother, brother, one dog, two cats, two parrots and four fish. How many legs do they have in total (including Helga)?

A 22                      B 28                      C 24                      D 23                      E 13

2. In a recent Mathematics competition, Roo had the fiftieth best result and, at the same time, the fiftieth worst result. How many pupils competed?

A 50                      B 75                      C 99                      D 100                      E 101

3. In the grid on the right, there are eight kangaroos. A kangaroo may jump into any empty square. Find the least number of the kangaroos which have to jump into an empty square so that in each row and column there are exactly two kangaroos.



A 0                      B 1                      C 2                      D 3                      E 4

4. Eighteen pupils are crossing the road in pairs. Each pair is labelled with a number from 1 to 9. Each pair with an even number consists of a boy and a girl, and each pair with an odd number consists of two boys. How many boys are crossing the road?

A 18                      B 14                      C 12                      D 11                      E 10

5. Kanga inflates 8 balloons every three minutes. Given that every tenth balloon bursts immediately after it has been inflated, how many inflated balloons will Kanga have after two hours?

A 160                      B 216                      C 240                      D 288                      E 320

6. In the diagram alongside, the five circles have the same radii and touch as shown. The square joins the centres of the four outer circles. The ratio of the area of the shaded parts of all five circles to the area of the unshaded parts of all five circles is



A 5 : 4                      B 2 : 3                      C 2 : 5                      D 1 : 4                      E 1 : 3

7. Kanga has ordered unusual building blocks, which are all cuboids of dimensions  $10\text{ cm} \times 12\text{ cm} \times 14\text{ cm}$ . Unfortunately a mistake is made and when the blocks arrive they measure  $12\text{ cm} \times 14\text{ cm} \times 16\text{ cm}$ . What is the percentage increase in the volume of the blocks?

A 20                      B 30                      C 40                      D 50                      E 60

8. In the diagram there are 7 squares. What is the difference between the number of triangles and the number of squares in the diagram?

A 0                      B 1                      C 2                      D 3                      E 4



9. Which of the following cubes can be folded from the net on the right?



A



B



C



D



E



10. Kanga and Roo are hopping around a stadium with a perimeter of 330m. Each of them makes one jump every second. Kanga's jumps are 5m long, while Roo's jumps are 2m long. They both start at the same point and move in the same direction. Roo gets tired and stops after 25 seconds whilst Kanga keeps jumping. How much more time passes before Kanga is next beside Roo?



A 15 seconds    B 24 seconds    C 51 seconds    D 66 seconds    E 76 seconds

11. What entry should replace  $x$  in the table so that the numbers in each row, each column and each diagonal form an arithmetic sequence?

				21
	16			
		27		
				$x$

(In an arithmetic sequence, there is a constant difference between successive terms.)

A 49    B 42    C 33    D 28    E 4

12. Whilst waiting 19 minutes for Rachel, Andrew gets bored and begins to count the number of buses which pass him. A red bus passes every 3 minutes and a blue bus passes every 5 minutes. Andrew decides to focus on the difference between the number of red and blue buses which pass him. How many different such differences are possible?

A 0    B 1    C 2    D 3    E 4

13. The diagram shows 3 semicircular arcs with the endpoints  $A, B$  of one arc and the centres  $E, F$  of the other two arcs at the vertices of a rectangle. What is the area of the shaded region when the radius of each semicircle is 2cm?



A  $(2\pi + 2)\text{cm}^2$     B  $8\text{cm}^2$     C  $(2\pi + 1)\text{cm}^2$   
D  $7\text{cm}^2$     E  $2\pi\text{cm}^2$

14. Roo has two full bottles of equal volume each containing a mixture of juice and water. In one bottle the ratio of water to juice is 2:1 and in the other the ratio is 4:1. When Roo mixes the contents of both bottles into one large jug the ratio of water to juice will then be

A 3:1    B 6:1    C 11:4    D 5:1    E 8:1

15. What is the sum of the 10 angles marked on the diagram on the right?

A  $300^\circ$     B  $450^\circ$     C  $360^\circ$     D  $600^\circ$     E  $720^\circ$



16. The average of 16 **different** positive integers is 16. What is the greatest possible value that any of these integers could have?

A 16    B 24    C 32    D 136    E 256

17. Heather has seventeen balls, numbered from 1 to 17, in a bag. She removes the balls, one at a time and at random. What is the smallest number of balls which Heather should remove to be sure that she has removed at least one pair whose numbers add up to 18?

A 7    B 8    C 10    D 11    E 17





A rectangle with length 24m and width 1m is cut into smaller rectangles, each of width 1m, as shown. There are four pieces with length 4m, two pieces with length 3m and one piece with length 2m. All these smaller rectangles are then rearranged without gaps or overlaps to form a new rectangle. What is the smallest possible perimeter of the new rectangle?

- A 14m      B 20m      C 22m      D 25m      E 28m
19. A car was driven at a constant speed of 90km/h. When the clock in the car showed 21:00, the daily mileage recorder showed 116.0, meaning that up to that moment 116.0km had been driven. Later that evening the mileage recorder showed the same row of numbers as the clock. At what time did that occur?

A 21:30      B 21:50      C 22:00      D 22:10      E 22:30

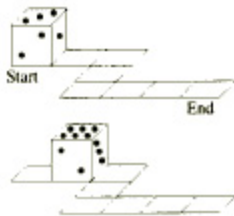
20. Let  $a$  and  $b$  be the lengths of the two shorter sides of the right-angled triangle shown in the diagram. The longest side,  $D$ , is the diameter of the large circle and  $d$  is the diameter of the small circle which touches all three sides of the triangle.



Which one of the following expressions is equal to  $D + d$ ?

- A  $(a + b)$       B  $2(a + b)$       C  $\frac{1}{2}(a + b)$       D  $\sqrt{ab}$       E  $\sqrt{a^2 + b^2}$
21. Every second day Charles tells the truth for the whole day, otherwise he lies for the whole day. Today he made exactly four of the following statements. Which statement could he not have made today?
- A I have a prime number of friends.      B I have as many male friends as female friends.  
C My name is Charles.      D I always speak the truth.  
E Three of my friends are older than me.

22. The numbers on each pair of opposite faces on a die add up to 7. A die is rolled without slipping around the circuit shown. At the start the top face is 3. What number will be displayed on the top face at the end point?



- A 2      B 3      C 4      D 5      E 6
23. How many positive integers,  $n$ , are there which satisfy the inequalities  $2000 < \sqrt{n(n+1)} < 2005$ ?
- A 1      B 2      C 3      D 4      E 5
24. How many four-digit divisors does the number  $102^2$  have?
- A 2      B 3      C 4      D 5      E 6
25. How many ways are there to choose a white square and a black square, such as those shown, from an  $8 \times 8$  chess board so that these squares do not lie in either the same row or the same column?



A 768      B 5040      C 720      D 56      E 672