

18. A coin with diameter 1 cm rolls around the outside of a regular hexagon with edges of length 1 cm until it returns to its original position. In centimetres, what is the length of the path traced out by the centre of the coin?

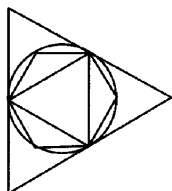


- A $6 + \pi/2$ B $12 + \pi$ C $6 + \pi$ D $12 + 2\pi$ E $6 + 2\pi$
19. In a box there are three red cards, three green cards, three yellow cards and three blue cards. For each colour, the three cards are numbered 1, 2 and 3. If you select three cards from the box at random, which of the following is most likely?

- A The three cards are the same colour.
 B The three cards are numbered 1, 2, 3 irrespective of colour.
 C The three cards are different colours.
 D The three cards have the same number.
 E None, the events A - D are equally likely.
20. A safe contains some diamond necklaces (at least two) and nothing else. The necklaces each have the same number of diamonds, and they all have at least two diamonds. The total number of diamonds is between 200 and 300. If you knew the total number of diamonds in the safe, then you would also know for certain the number of necklaces. How many necklaces are there in the safe?

- A 16 B 17 C 19 D 25 E 28

21. An equilateral triangle and a regular hexagon are inscribed in a circle which is itself inscribed in an equilateral triangle. L is the area of the large triangle, S is the area of the smaller triangle and H is the area of the hexagon. Which of these statements is true?

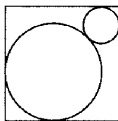


- A $L = H + 3S$ B $H = LS$ C $H = \frac{1}{2}(L + S)$
 D $H = L - S$ E $H = \sqrt{LS}$

22. Let N be the smallest integer such that $10 \times N$ is a perfect square and $6 \times N$ is a perfect cube. How many positive factors does N have?

- A 30 B 40 C 54 D 72 E 96

23. Two circles have their centres on the same diagonal of a square. They touch each other and the sides of the square as shown. The square has side length 1cm. What is the sum of the radii of the circles in centimetres?



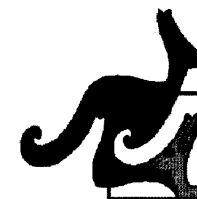
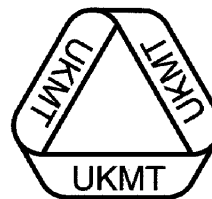
- A $\frac{1}{2}$ B $\frac{1}{\sqrt{2}}$ C $\sqrt{2} - 1$ D $2 - \sqrt{2}$
 E It depends on the relative sizes of the circles.

24. At a party, five girls give each other gifts in such a way that everybody gives one gift and everybody receives one (though of course nobody receives her own gift). How many possible ways are there for this to happen?

- A 5 B 10 C 44 D 50 E 120

25. The distance between two non-adjacent edges of a regular tetrahedron is 6 cm. What is the volume of the tetrahedron in cm^3 ?

- A 18 B 36 C 48 D 72 E 144



EUROPEAN 'KANGAROO' MATHEMATICAL CHALLENGE
 'PINK'

Thursday 15th March 2007

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):

- Do not open the paper until the Invigilator tells you to do so.
- Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
- The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
- 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.
- 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.
- 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.
- 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.
- 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)

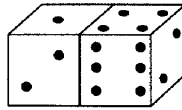
<http://www.ukmt.org.uk>

1. Andy, Benny and Charlie have thirty balls altogether. If Benny gives five to Charlie, Charlie gives four to Andy and Andy gives two to Benny, then the three boys will each have the same number of balls. How many balls did Andy have to start with?

A 8 B 9 C 11 D 13 E 15

2. The diagram shows two ordinary dice. What is the total number of spots on all the faces that cannot be seen in the diagram?

A 27 B 24 C 15 D 12 E none of these



3. An international organisation has 32 members. Every year the number of members increases by 50%. How many members will it have three years from now?

A 182 B 128 C 108 D 96 E 80

4. In a triangle JKL , M is the midpoint of JK , N is the midpoint of MK and P is the midpoint of KL . If the area of triangle JKL is 96, what is the area of triangle JNP ?

A 16 B 24 C 32 D 36 E 48

5. Beth has divided her 2007 marbles into three bags A, B, C in such a way that each bag contains exactly the same number of marbles. Beth then moves two-thirds of the marbles in bag A to bag C. What is the new ratio of marbles in bag A to bag C?

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

6. To complete the table, each cell must contain either 0 or 1, and the total of each row and column must be 2. What are the values of the entries X and Y ?

A $X = 0, Y = 0$ B $X = 0, Y = 1$ C $X = 1, Y = 0$
D $X = 1, Y = 1$ E It is impossible to complete.

0		0	
		0	
	X		1
	Y		

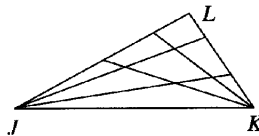
7. In the calculation alongside, different letters represent different digits. Find the least possible answer to the subtraction shown.

A 100 B 110 C 112 D 119 E 129

$$\begin{array}{r} 2007 \\ - \text{KAN} \\ - \text{GA} \\ - \text{ROO} \\ \hline \end{array}$$

8. The diagram shows a triangle JKL where two lines are drawn from each of the vertices J and K to points on the opposite sides. This divides the triangle into nine non-overlapping sections. If instead, eight lines are drawn to the opposite sides, four from J and four from K , how many non-overlapping sections would the triangle be divided into?

A 16 B 25 C 36 D 42 E 49



9. A magical island is inhabited by knights (who always tell the truth) and liars (who always lie). One day twelve islanders (including both knights and liars) gathered together and issued three statements. Two people said, 'There are exactly two liars among us'. Four other people said, 'There are exactly four liars among us'. The remaining six people said, 'There are exactly six liars among us'. How many liars were there?

A 2 B 4 C 6 D 8 E 10

10. To what power should we raise raise 4^4 to get 8^8 ?

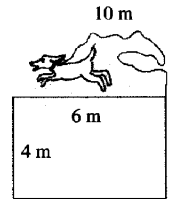
A 2 B 3 C 4 D 8 E 16

11. Some students tried to solve a problem in the Kangaroo competition. The number of boys who solved the problem correctly was equal to the number of girls who did not solve the problem correctly. Which of the following statements is true?

A The number of girls is more than the number of students who solved the problem correctly.
B The number of girls is less than the number of students who solved the problem correctly.
C The number of girls is equal to the number of students who solved the problem correctly.
D The situation is impossible.
E We need more information to decide on options A, B or C.

12. A dog is tied to the outside corner of a house by a rope of length 10m. The house is a rectangle with sides of length 6m and 4m. What is the length (in metres) of the curved boundary of the area in which the dog can roam?

A 20π B 22π C 40π D 88π E 100π



13. At 9pm, Michael is driving his car at 100km/h. At this velocity he has enough petrol to cover a distance of 80km. Unfortunately the nearest petrol pump is 100km away. The amount of petrol his car uses per km is proportional to the velocity of the car. What is the earliest time that Michael can arrive at the petrol pump?

A 10:12pm B 10:15pm C 10:20pm D 10:25pm E 10:30pm

14. A trapezium is formed by removing one corner of an equilateral triangle. Then two copies of this trapezium are placed side by side to form a parallelogram. The perimeter of the parallelogram is 10cm longer than the perimeter of the original triangle. What was the perimeter of the original triangle?

A 10cm B 30cm C 40cm D 60cm E more information needed

15. A sequence of letters KANGAROOKANGAROO...KANGAROO is formed by repeating the word KANGAROO twenty times. A new sequence is formed by erasing alternate letters, starting with the first letter. Then, in this new sequence, alternate letters are again removed, starting with the first letter. This process is repeated until only one letter is left. What letter remains?

A K B A C N D G E O

16. Two schools play against each other in a table tennis tournament. Each school is represented by five students. Every game is a doubles game, and every possible pair from the first school must play one game against every possible pair from the second school. How many games will each student play?

A 10 B 20 C 30 D 40 E 50

17. In the village of Snippy, no two people have the same number of hairs and nobody has exactly 2007 hairs. Barbara has the greatest number of hairs in the village and this number is less than the number of villagers. What is the largest possible number of villagers that there could be in Snippy?

A 2 B 2006 C 2007 D 2008 E It is impossible to determine.