

Junior Kangaroo Mathematical Challenge

Tuesday 14th June 2016

Organised by the United Kingdom Mathematics Trust

The Junior Kangaroo allows students in the UK to test themselves on questions set for young mathematicians from across Europe and beyond.

RULES AND GUIDELINES (to be read before starting):

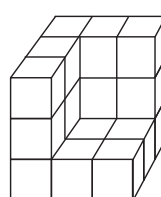
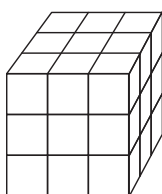
1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England and Wales must be in School Year 8 or below.
Candidates in Scotland must be in S2 or below.
Candidates in Northern Ireland must be in School Year 9 or below.
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 Junior Kangaroo should be sent to: Maths Challenges Office,
School of Mathematics, University of Leeds, Leeds, LS2 9JT.*

(Tel. 0113 343 2339)

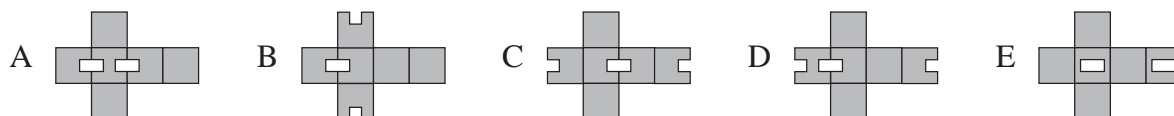
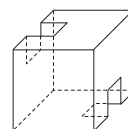
<http://www.ukmt.org.uk>

- At which of these times is the angle between the minute hand and the hour hand of a clock equal to 150° ?
A 9 pm B 8 pm C 6 pm D 5 pm E 4 pm
- Twelve people, and no more, can sit evenly spaced around a large square table. Rohan arranges eight of these square tables in a row to make one long rectangular table. What is the maximum number of people that can sit evenly spaced around this long table?
A 48 B 54 C 60 D 80 E 96
- A ball and a bat cost £90 in total. Three balls and two bats cost £210 in total. How much does a bat cost?
A £20 B £30 C £40 D £50 E £60
- It takes 9 litres of paint to cover the surface of the cube on the left.

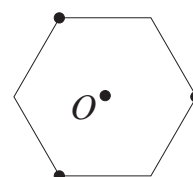


How much paint would it take to cover the surface of the shape on the right?

- A 9 litres B 8 litres C 6 litres D 4 litres E 2 litres
- What is 10% of 30% of 50% of 7000?
A 15 B 105 C 150 D 501 E 510
- Miss Spelling has enough sheets of paper to give each pupil in her class 3 sheets and have 31 sheets left over. Alternatively, she could give each pupil 4 sheets and have 8 sheets left over. How many sheets of paper does she have?
A 31 B 34 C 43 D 91 E 100
- Which of the following nets can be used to build the partial cube shown in the diagram?

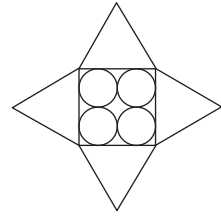


- One angle of an isosceles triangle is 30° . Which of the following could be the difference between the other two angles?
A 30° B 60° C 70° D 80° E 90°
- A piece of paper in the shape of a regular hexagon, as shown, is folded so that the three marked vertices meet at the centre O of the hexagon. What is the shape of the figure that is formed?



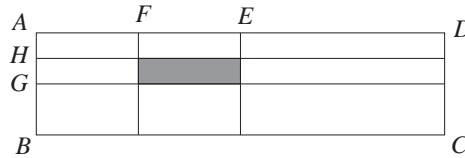
- A Six-pointed star B Dodecagon C Hexagon
D Square E Equilateral Triangle

10. Four circles of radius 5 cm touch the sides of a square and each other, as shown in the diagram. On each side of the square, an equilateral triangle is drawn to form a four-pointed star.



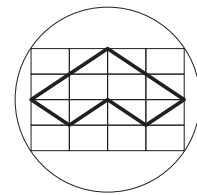
What is the perimeter of the star?

- A 40 cm B 80 cm C 120 cm D 160 cm E 200 cm
11. Joey calculated the sum of the largest and smallest two-digit numbers that are multiples of three. Zoë calculated the sum of the largest and smallest two-digit numbers that are not multiples of three. What is the difference between their answers?
- A 2 B 3 C 4 D 5 E 6
12. The diagram shows a rectangle $ABCD$ in which $AB = 1$ metre and $AD = 4$ metres. The points E and G are the midpoints of AD and AB and the points F and H are the midpoints of AE and AG .



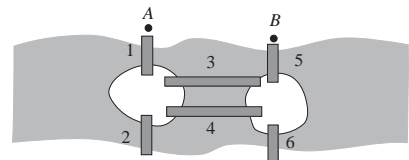
What is the area of the shaded rectangle?

- A $\frac{1}{16} \text{ m}^2$ B $\frac{1}{8} \text{ m}^2$ C $\frac{1}{4} \text{ m}^2$ D $\frac{1}{2} \text{ m}^2$ E 1 m^2
13. The tens digit of a two-digit number is three more than the units digit. When this two-digit number is divided by the sum of its digits, the answer is 7 remainder 3. What is the sum of the digits of the two-digit number?
- A 5 B 7 C 9 D 11 E 13
14. How many different cubes are there with three faces coloured red and three faces coloured blue?
- A 1 B 2 C 3 D 4 E 5
15. The diameter of the circle shown is 10 cm. The circle passes through the vertices of a large rectangle which is divided into 16 identical smaller rectangles.



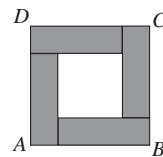
What is the perimeter of the shape drawn with a dark line?

- A 10 cm B 16 cm C 20 cm D 24 cm E 30 cm
16. The diagram shows part of a river which has two islands in it. There are six bridges linking the islands and the two banks as shown. Leonhard goes for a walk every day in which he walks over each bridge exactly once. He always starts at point A, goes first over bridge 1 and always finishes at point B. What is the maximum number of days that he can walk without repeating the order in which he crosses the bridges?



- A 2 B 4 C 5 D 6 E More than 6

17. The square $ABCD$ consists of four congruent rectangles arranged around a central square. The perimeter of each of the rectangles is 40 cm. What is the area of the square $ABCD$?



A 400 cm^2 B 200 cm^2 C 160 cm^2 D 120 cm^2 E 80 cm^2

18. When Ellen went to the shop, she found she could spend all her money on 6 cans of cola and 7 croissants or on 8 cans of cola and 4 croissants. If she decided to buy only croissants, how many croissants could she buy?

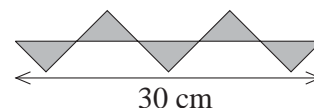
A 12 B 13 C 15 D 16 E 25

19. Adam, Bill and Chris went swimming 15 times last summer. Adam paid for everyone eight times and Bill paid for everyone seven times. At the end of the summer, Chris calculated that he owed £30. How should he split this between Adam and Bill so that each has paid the same amount?

A £22 to Adam and £8 to Bill B £20 to Adam and £10 to Bill
C £18 to Adam and £12 to Bill D £16 to Adam and £14 to Bill
E £15 to Adam and £15 to Bill

20. The diagram shows five congruent right-angled isosceles triangles. What is the total area of the triangles?

A 25 cm^2 B 30 cm^2 C 35 cm^2 D 45 cm^2 E 60 cm^2



21. In Carl's pencil case there are nine pencils. At least one of the pencils is blue. In any group of four pencils, at least two have the same colour. In any group of five pencils, at most three have the same colour. How many pencils are blue?

A 1 B 2 C 3 D 4 E More information needed

22. Lewis drives from London to Brighton at an average speed of 60 mph. On the way back, he gets stuck in traffic and his average speed is only 40 mph. What is his average speed for the whole journey?

A 55 mph B 50 mph C 48 mph D 45 mph E Impossible to determine

23. In the addition sum below, a , b and c stand for different digits.

$$\begin{array}{r} a b c \\ + a c b \\ \hline c 4 a. \end{array}$$

What is the value of $a + b + c$?

A 20 B 19 C 18 D 17 E 16

24. The lengths of three adjacent sides of a quadrilateral are equal. The angle between the first and second of these sides is 60° and the angle between the second and third of these sides is 100° . What is the largest angle of the quadrilateral?

A 130° B 140° C 145° D 150° E 160°

25. The whole numbers from 1 to 2016 inclusive are written on a blackboard. Moritz underlines all the multiples of two in red, all the multiples of three in blue and all the multiples of four in green. How many numbers does Moritz underline exactly twice?

A 1008 B 1004 C 504 D 336 E 168