Junior Kangaroo Mathematical Challenge

Tuesday 13th June 2017

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):

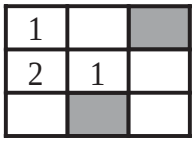
1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
   No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England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

1. Kieran the Kangaroo takes 6 seconds to make 4 jumps. How long does it take him to make 30 jumps?

A 30 seconds B 36 seconds C 42 seconds D 45 seconds E 48 seconds

2. Sophie wants to complete the grid shown so that each row and each column of the grid contains the digits 1, 2 and 3 exactly once. What is the sum of the digits she will write in the shaded cells?

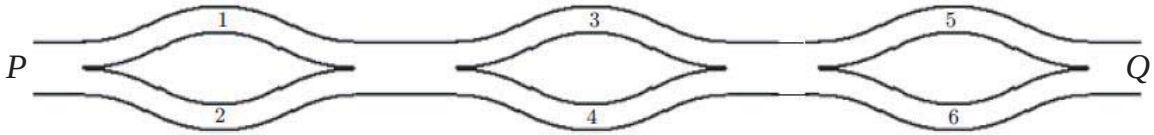


A 2 B 3 C 4 D 5 E 6

3. Ben has exactly the right number of cubes, each of side 5 cm, to make a solid cube of side 1 m. He places the smaller cubes side by side to form a single row. How long is this row?

A 5 km B 400 m C 300 m D 20 m E 1 m

4. Beattie wants to walk from *P* to *Q* along the paths shown, always moving in the direction from *P* to *Q*.



She will add the numbers on the paths she walks along. How many different totals could she obtain?

A 3 B 4 C 5 D 6 E 8

5. Anna is 13 years old. Her mother Annie is three times as old as Anna. How old will Annie be when Anna is three times as old as she is now?

A 13 B 26 C 39 D 52 E 65

6. Hasan writes down a two-digit number. He then writes the same two-digit number next to his original number to form a four-digit number. What is the ratio of his four-digit number to his two-digit number ?

A 2 : 1 B 100 : 1 C 101 : 1 D 1001 : 1 E It depends on his number

7. A square piece of card has perimeter 20 cm. Charlie cuts the card into two rectangles. The perimeter of one of the rectangles is 16 cm. What is the perimeter of the other rectangle?

A 4 cm B 8 cm C 10 cm D 12 cm E 14 cm

8. Niko counted a total of 60 birds perching in three trees. Five minutes later, 6 birds had flown away from the first tree, 8 birds had flown away from the second tree and 4 birds had flown away from the third tree. He noticed that there was now the same number of birds in each tree. How many birds were originally perched in the second tree?

A 14 B 18 C 20 D 21 E 22

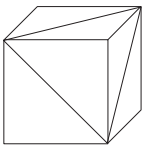
9. Alex colours all the small squares that lie on the two longest diagonals of a square grid. She colours 2017 small squares. What is the size of the square grid?

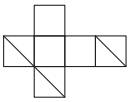
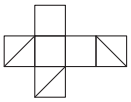
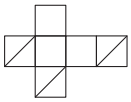
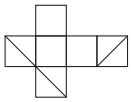
A 1009×1009 B 1008×1008 C 2017×2017 D 2016×2016 E 2015×2015

10. In the sequence of letters KANGAROOKANGAROOKANG... the word KANGAROO is repeated indefinitely. What is the 2017th letter in this sequence?

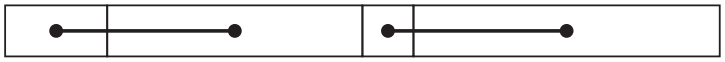
A K B N C G D R E O

11. A cube has diagonals drawn on three adjacent faces as shown in the diagram. Which of the following nets could Usman use to make the cube shown?



A  B  C  D  E none of those shown

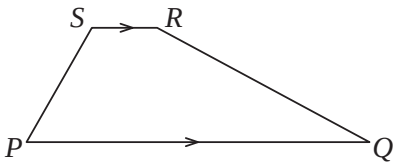
12. Maddie has a paper ribbon of length 36 cm. She divides it into four rectangles of different lengths. She draws two lines joining the centres of two adjacent rectangles as shown.



What is the sum of the lengths of the lines that she draws?

A 18 cm B 17 cm C 20 cm D 19 cm E It depends upon the sizes of the rectangles

13. In trapezium $PQRS$, $\angle RSP = 2 \times \angle SPQ$ and $\angle SPQ = 2 \times \angle PQR$. Also $\angle QRS = k \times \angle PQR$. What is the value of k?

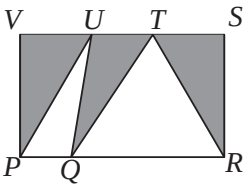


A 2 B 3 C 4 D 5 E 6

14. Taran thought of a whole number and then multiplied it by either 5 or 6. Krishna added 5 or 6 to Taran's answer. Finally Eshan subtracted either 5 or 6 from Krishna's answer. The final result was 73. What number did Taran choose?

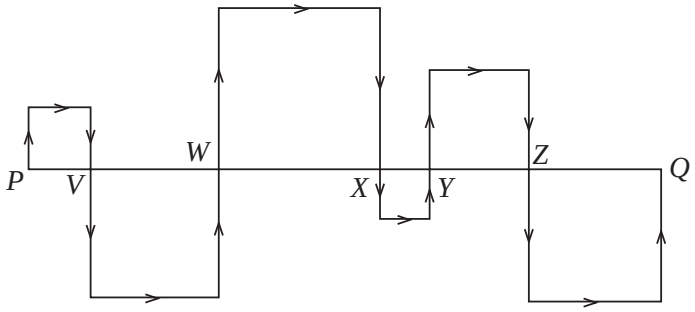
A 10 B 11 C 12 D 13 E 14

15. In the diagram, $PRSV$ is a rectangle with $PR = 20$ cm and $PV = 12$ cm. Jeffrey marks points U and T on VS and Q on PR as shown. What is the shaded area?



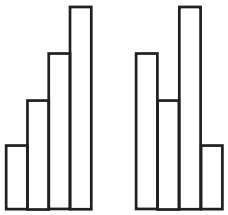
A More information needed B 60 cm^2
C 100 cm^2 D 110 cm^2 E 120 cm^2

16. The line PQ is divided into six parts by the points V, W, X, Y and Z. Squares are drawn on PV, VW, WX, XY, YZ and ZQ as shown in the diagram. The length of line PQ is 24 cm. What is the length of the path from P to Q indicated by the arrows?



A 48 cm B 60 cm C 66 cm D 72 cm E 96 cm

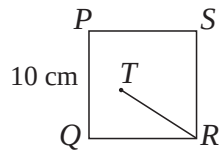
17. Henna has four hair ribbons of width 10 cm. When she measures them, she finds that each ribbon is 25 cm longer than the next smallest ribbon. She then arranges the ribbons to form two different shapes as shown in the diagram.



How much longer is the perimeter of the second shape than the perimeter of the first shape?

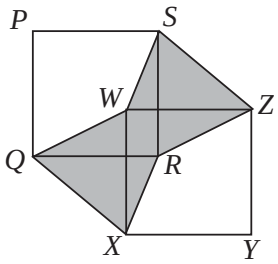
A 75 cm B 50 cm C 25 cm D 20 cm E 0 cm

18. In the diagram, $PQRS$ is a square of side 10 cm. T is a point inside the square so that $\angle SPT = 75°$ and $\angle TSP = 30°$. What is the length of TR?



A 8 cm B 8.5 cm C 9 cm D 9.5 cm E 10 cm

19. In the diagram, $PQRS$ and $WXYZ$ are congruent squares. The sides PS and WZ are parallel. The shaded area is equal to 1 cm^2.
What is the area of square $PQRS$?

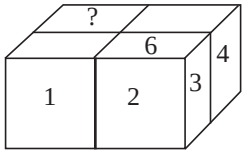


A 1 cm^2 B 2 cm^2 C $\frac{1}{2}$ cm^2 D $1\frac{1}{2}$ cm^2 E $\frac{3}{4}$ cm^2

20. The multiplication $abc \times de = 7632$ uses each of the digits 1 to 9 exactly once. What is the value of b?

A 1 B 4 C 5 D 8 E 9

21. Rory uses four identical standard dice to build the solid shown in the diagram.
Whenever two dice touch, the numbers on the touching faces are the same. The numbers on some of the faces of the solid are shown. What number is written on the face marked with question mark?
(On a standard die, the numbers on opposite faces add to 7.)

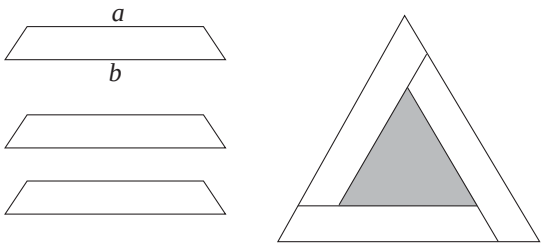


A 6 B 5 C 4 D 3 E 2

22. Harriet tells Topaz that she is thinking of three positive integers, not necessarily all different. She tells her that the product of her three integers is 36. She also tells her the sum of her three integers. However, Topaz still cannot work out what the three integers are.
What is the sum of Harriet's three integers?

A 10 B 11 C 13 D 14 E 16

23. Three congruent isosceles trapeziums are assembled to form an equilateral triangle with a hole in the middle, as shown in the diagram.



What is the perimeter of the hole?

A $3a + 6b$ B $3b - 6a$ C $6b - 3a$ D $6a + 3b$ E $6a - 3b$

24. Jacob and Zain take pencils from a box of 21 pencils without replacing them. On Monday Jacob takes $\frac{2}{3}$ of the number of pencils that Zain takes. On Tuesday Jacob takes $\frac{1}{2}$ of the number of pencils that Zain takes. On Wednesday morning the box is empty. How many pencils does Jacob take?

A 8 B 7 C 6 D 5 E 4

25. How many three-digit numbers are equal to 34 times the sum of their digits?

A 0 B 1 C 2 D 3 E 4