UK Maths Trust

Grey Kangaroo

Thursday 21 March 2024

a member of the Association Kangourou sans Frontières

supported by RESEARCH Overleaf

England & Wales: Year 9 or below
Scotland: S2 or below
Northern Ireland: Year 10 or below

Instructions

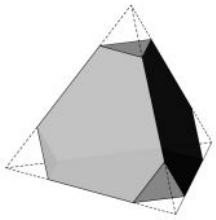
1. Do not open the paper until the invigilator tells you to do so.
2. Time allowed: **60 minutes**.
   No answers, or personal details, may be entered after the allowed time is over.
3. The use of blank or lined paper for rough working is allowed; **squared paper**, **calculators and measuring instruments are forbidden**.
4. **Use a B or an HB non-propelling pencil.** Mark at most one of the options A, B, C, D, E on the Answer Sheet for each question. Do not mark more than one option.
5. **Do not expect to finish the whole paper in the time allowed.** The questions in this paper have been arranged in approximate order of difficulty with the harder questions towards the end. You are not expected to complete all the questions during the time. You should bear this in mind when deciding which questions to tackle.
6. **Scoring rules:**
   5 marks are awarded for each correct answer to Questions 1-15;
   6 marks are awarded for each correct answer to Questions 16-25;
   In this paper you will not lose marks for getting answers wrong.
7. **Your Answer Sheet will be read by a machine.** Do not write or doodle on the sheet except to mark your chosen options. The machine will read all black pencil markings even if they are in the wrong places. If you mark the sheet in the wrong place, or leave bits of eraser stuck to the page, the machine will interpret the mark in its own way, or reject the answer sheet.
8. **The questions on this paper are designed to challenge you to think, not to guess.** You will gain more marks, and more satisfaction, by doing one question carefully than by guessing lots of answers. This paper is about solving interesting problems, not about lucky guessing.

Enquiries about the Grey Kangaroo should be sent to:

challenges@ukmt.org.uk

www.ukmt.org.uk

1. Julio cuts off the four corners, or vertices, of a regular tetrahedron, as shown. How many vertices does the remaining shape have?



A 8 B 9 C 11 D 12 E 15

2. What is the value of $\dfrac{20 \times 24}{2 \times 0 + 2 \times 4}$?

A 12 B 30 C 48 D 60 E 120

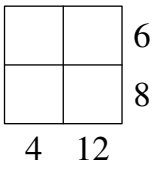
3. Ria has three counters marked 1, 5 and 11, as shown. She wants to place them side-by-side to make a four-digit number. How many different four-digit numbers can she make?

A 3 B 4 C 6 D 8 E 9

4. The maximum weight allowed in a service lift is satisfied exactly by 12 identical large packages or by 20 identical small packages. What is the greatest number of small packages that the lift can carry alongside nine large packages?

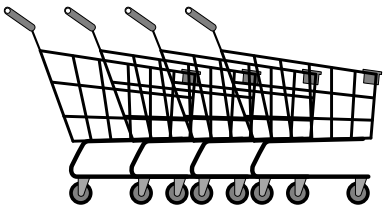
A 3 B 4 C 5 D 6 E 8

5. Four different positive integers are placed on a grid and then covered up. The product of the integers in each row and column is shown in the diagram. What is the sum of the four integers?



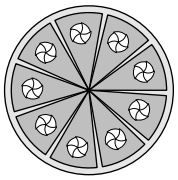
A 10 B 12 C 13 D 14 E 15

6. The length of a set of four well-parked and fitted trolleys is 108 cm. The length of a set of ten well-parked and fitted trolleys is 168 cm. What is the length of a single trolley?



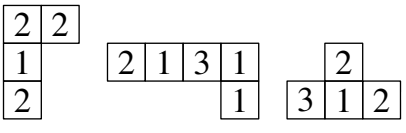
A 60 cm B 68 cm C 78 cm D 88 cm E 90 cm

7. Carina baked a cake and cut it into ten equal pieces. She ate one piece and then arranged the remaining pieces evenly, as shown. What is the size of the angle at the centre of the cake between any two adjacent pieces?



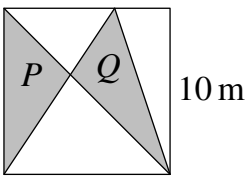
A 5° B 4° C 3° D 2° E 1°

8. Werner can make a 4×4 square, where the sums of the numbers in all four rows and in all four columns are the same, from the three pieces shown and one further piece. Which of the following pieces is needed to complete his square?



A 1 1 3 B 2 1 0 C 1 2 1 D 2 2 2 E 2 2 3

9. A square has side-length 10 m. It is divided into parts by three straight line segments, as shown. The areas of the two shaded triangles are P m^2 and Q m^2. What is the value of $P - Q$?

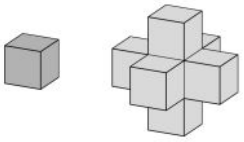


A 0 B 1 C 2 D 5 E 10

10. Paula the penguin goes fishing every day and always brings back twelve fish for her two chicks. Each day, she gives the first chick she sees seven fish and gives the second chick five fish, which they eat. In the last few days one chick has eaten 44 fish. How many has the other chick eaten?

A 34 B 40 C 46 D 52 E 64

11. Johan has a large number of identical cubes. He has made the structure on the right by taking a single cube and then sticking another cube to each face. He wants to make an extended structure in the same way so that each face of the structure on the right will have a cube stuck to it. How many extra cubes will he need to complete his extended structure?



A 10 B 12 C 14 D 16 E 18

12. Kenny the kangaroo jumps up a mountain and then jumps back down along the same route. He covers three times the distance with each downhill jump as he does with each uphill jump. Going uphill, he covers 1 metre per jump. In total, Kenny makes 2024 jumps. What is the total distance, in metres, that Kenny jumps?

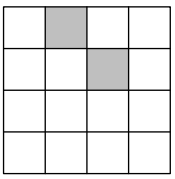
A 506 B 1012 C 2024 D 3036 E 4048

13. Gerard cuts a large rectangle into four smaller rectangles. The perimeters of three of these smaller rectangles are 16, 18 and 24, as shown in the diagram. What is the perimeter of the fourth small rectangle?

18	?
24	16

A 8 B 10 C 12 D 14 E 16

14. Tarek wants to shade two further squares on the diagram shown so that the resulting pattern has a single axis of symmetry. In how many different ways can he complete his pattern?



A 2 B 3 C 4 D 5 E 6

15. Nine cards numbered from 1 to 9 were placed facedown on the table. Aleksa, Bart, Clara and Deindra each picked up two of the cards. Aleksa said, "My numbers add up to 6." Bart said, "The difference between my numbers is 5." Clara said, "The product of my numbers is 18." Deindra said, "One of my numbers is twice the other one." All four made a true statement. Which number was left on the table?

A 1 B 3 C 6 D 8 E 9

16. The digits 0 to 9 can be drawn with horizontal and vertical segments, as shown. Greg chooses three different digits. In total, his digits have 5 horizontal segments and 10 vertical segments. What is the sum of his three digits?

A 9 B 10 C 14 D 18 E 19

17. Water makes up 80 per cent of fresh mushrooms. However, water makes up only 20 per cent of dried mushrooms. By what percentage does the mass of a fresh mushroom decrease during drying?

A 60 B 70 C 75 D 80 E 85

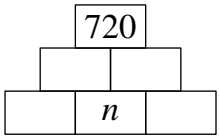
18. How many eight-digit numbers can be written using only the digits 1, 2 and 3 so that the difference between any two adjacent digits is 1?

A 16 B 20 C 24 D 28 E 32

19. A group of 50 girls sit in a circle. They throw a ball around the circle. Each girl who gets the ball throws it to the girl sitting six places anticlockwise from her, who catches it. Freda catches the ball 100 times. In that time, how many girls never get to catch the ball?

A 0 B 8 C 10 D 25 E 40

20. Donggyu wants to complete the diagram so that each box contains a positive integer and each box in the top two rows contains the product of the integers in the two boxes below it. He wants the integer in the top box to be 720. How many different values can the integer n take?

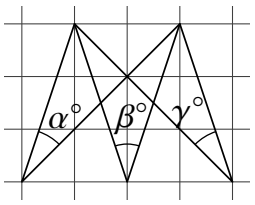


A 1 B 4 C 5 D 6 E 8

21. Farmer Fi is selling chicken and duck eggs. She has baskets holding 4, 6, 12, 13, 22 and 29 eggs. Her first customer buys all the eggs in one basket. Fi notices that the number of chicken eggs she has left is twice the number of duck eggs. How many eggs did the customer buy?

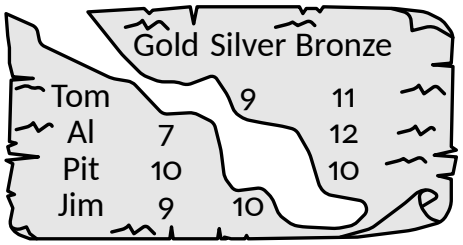
A 4 B 12 C 13 D 22 E 29

22. Three angles α°, β° and γ° are marked on squared paper, as shown. What is the value of $\alpha + \beta + \gamma$?



A 60 B 70 C 75 D 90 E 120

23. Captain Flint asked four of his pirates to write on a piece of paper how many gold, silver and bronze coins were in the treasure chest. Their responses are shown in the diagram but unfortunately part of the paper was damaged. Only one of the four pirates told the truth. The other three lied in all their answers. The total number of coins was 30. Who told the truth?

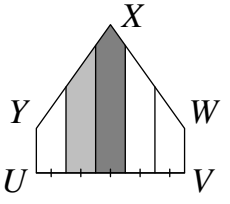


A Tom B Al C Pit D Jim
E We cannot be sure

24. Alex drives from point P to point Q, then immediately returns to P. Bob drives from point Q to point P, then immediately returns to Q. They travel on the same road, start at the same time and each travels at a constant speed. Alex's speed is three times Bob's speed. They meet each other for the first time 15 minutes after the start. How long after the start will they meet each other for the second time?

A 20 min B 25 min C 30 min D 35 min E 45 min

25. In the pentagon $UVWXY$, $\angle U = \angle V = 90^\circ$, $UY = VW$ and $YX = XW$. Four equally spaced points are marked between U and V, and perpendiculars are drawn through each point, as shown in the diagram. The dark shaded region has an area of 13 cm^2 and the light shaded region has an area of 10 cm^2. What is the area, in cm^2, of the entire pentagon?



A 45 B 47 C 49 D 58 E 60

