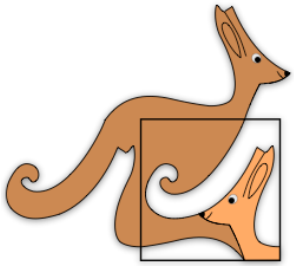
United Kingdom Mathematics Trust



Grey Kangaroo

Thursday 21 March 2019

Organised by the United Kingdom Mathematics Trust

a member of the Association Kangourou sans Frontières

Supported by Overleaf

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

Instructions

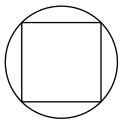
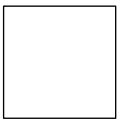
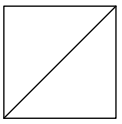
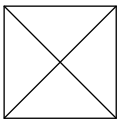
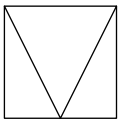
1. Do not open the paper until the invigilator tells you to do so.
2. Time allowed: **60 minutes**.
   No answers, or personal details, may be entered after the allowed time is over.
3. The use of blank or lined paper for rough working is allowed; **squared paper**, **calculators and measuring instruments 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.
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:

UK Mathematics Trust, School of Mathematics, University of Leeds, Leeds LS2 9JT

☎ 0113 343 2339 enquiry@ukmt.org.uk www.ukmt.org.uk

1. Which of the diagrams below cannot be drawn without lifting your pencil off the page and without drawing along the same line twice?

A  B  C  D  E 

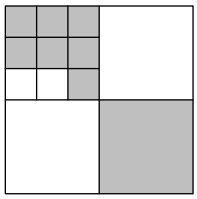
2. The expression $2 - 0 - 1 - 9$ contains four digits and three minus signs. What is the largest value that can be obtained by inserting exactly one pair of brackets into the expression?

A 13 B 12 C 10 D 9 E 8

3. Kerry writes a list of all the integers from 1 to n on a whiteboard. She uses the digit 0 five times and the digit 9 six times. What is the value of n?

A 39 B 49 C 59 D 69 E 99

4. A large square is divided into smaller squares, as shown. What fraction of the large square is shaded grey?



A $\frac{2}{3}$ B $\frac{2}{5}$ C $\frac{4}{7}$ D $\frac{4}{9}$ E $\frac{5}{12}$

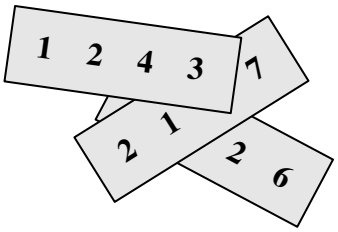
5. In a race, Lotar finished before Manfred, Victor finished after Jan, Manfred finished before Jan and Eddy finished before Victor. Who finished last of these five runners?

A Victor B Manfred C Lotar D Jan E Eddy

6. Five friends all brought some cakes with them when they met. Each of them gave a cake to each of the others. They then ate all the cakes they had just been given. As a result, the total number of cakes they had between them decreased by half. How many cakes did the five friends have at the start?

A 20 B 24 C 30 D 40 E 60

7. A four-digit integer is written on each of three pieces of paper and the pieces of paper are arranged so that three of the digits are covered, as shown. The sum of the three four-digit integers is 10 126. What are the covered digits?

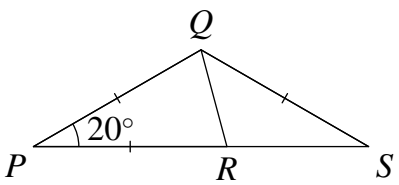


A 5, 6 and 7 B 4, 5 and 7 C 4, 6 and 7 D 4, 5 and 6
E 3, 5 and 6

8. Andrew divided some apples into six equal piles. Boris divided the same number of apples into five equal piles. Boris noticed that each of his piles contained two more apples than each of Andrew's piles. How many apples did Andrew have?

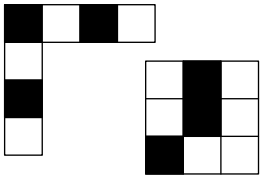
A 30 B 55 C 60 D 75 E 90

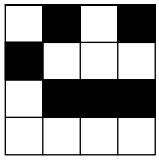
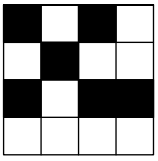
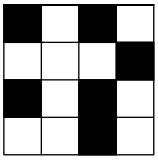
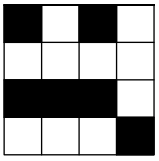
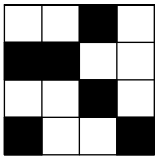
9. In the diagram, $PQ = PR = QS$ and $\angle QPR = 20°$. What is $\angle RQS$?



A 50° B 60° C 65° D 70° E 75°

10. Which of the following 4×4 tiles cannot be formed by combining the two given pieces?



A  B  C  D  E 

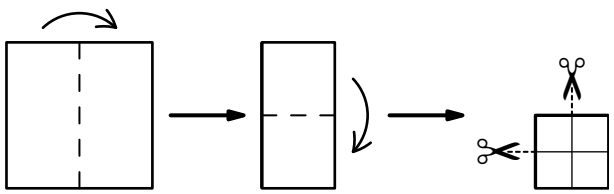
11. Alan, Bella, Claire, Dora, and Erik met together and shook hands exactly once with everyone they already knew. Alan shook hands once, Bella shook hands twice, Claire shook hands three times and Dora shook hands four times. How many times did Erik shake hands?

A 1 B 2 C 3 D 4 E 5

12. Jane was playing basketball. After a series of 20 shots, Jane had a success rate of 55%. Five shots later, her success rate had increased to 56%. On how many of the last five shots did Jane score?

A 1 B 2 C 3 D 4 E 5

13. Cathie folded a square sheet of paper in half twice and then cut it through the middle twice, as shown in the diagram, before unfolding it all. How many of the pieces that she obtained were squares?

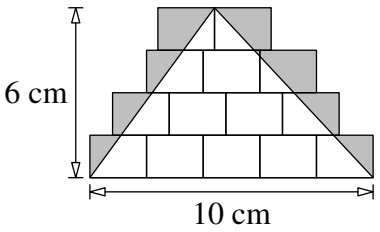


A 3 B 4 C 5 D 6 E 8

14. Michael keeps dogs, cows, cats and kangaroos as pets. He has 24 pets in total and $\frac{1}{8}$ of them are dogs, $\frac{3}{4}$ are not cows and $\frac{2}{3}$ are not cats. How many kangaroos does Michael keep?

A 4 B 5 C 6 D 7 E 8

15. Some identical rectangles are drawn on the floor. A triangle of base 10 cm and height 6 cm is drawn over them, as shown, and the region inside the rectangles and outside the triangle is shaded. What is the area of the shaded region?



A 10 cm^2 B 12 cm^2 C 14 cm^2 D 15 cm^2 E 21 cm^2

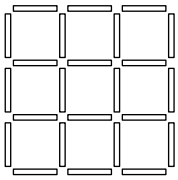
16. Chloe chose a three-digit integer with all its digits different and wrote it on lots of pieces of paper. Peter picked some of the pieces of paper and added the three-digit integers on them. His answer was 2331. How many pieces of paper did Peter pick?

A 2331 B 21 C 9 D 7 E 3

17. Julio has two cylindrical candles with different heights and diameters. The two candles burn wax at the same uniform rate. The first candle lasts 6 hours, while the second candle lasts 8 hours. He lights both candles at the same time and three hours later both candles are the same height. What is the ratio of their original heights?

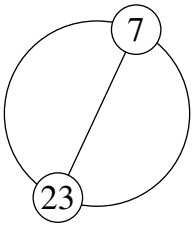
A 4 : 3 B 8 : 5 C 5 : 4 D 3 : 5 E 7 : 3

18. Natasha has many sticks of length 1. Each stick is coloured blue, red, yellow or green. She wants to make a 3×3 grid, as shown, so that each 1×1 square in the grid has four sides of different colours. What is the smallest number of green sticks that she could use?



A 3 B 4 C 5 D 6 E 7

19. The integers from 1 to n, inclusive, are equally spaced in order round a circle. The diameter through the position of the integer 7 also goes through the position of 23, as shown. What is the value of n?

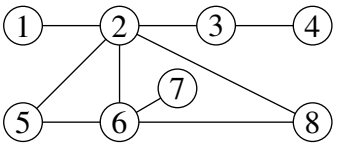


A 30 B 32 C 34 D 36 E 38

20. Liam spent all his money buying 50 soda bottles at the corner shop for £1 each. He sold each bottle at the same higher price. After selling 40 bottles, he had £10 more than he started with. He then sold all the remaining bottles. How much money did Liam have once all the bottles were sold?

A £70 B £75 C £80 D £90 E £100

21. Prab painted each of the eight circles in the diagram red, yellow or blue such that no two circles that are joined directly were painted the same colour. Which two circles must have been painted the same colour?



A 5 and 8 B 1 and 6 C 2 and 7 D 4 and 5 E 3 and 6

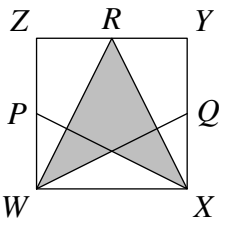
22. When Ria and Flora compared the amounts of money in their savings accounts, they found that their savings were in the ratio 5 : 3. Then Ria took 160 euros from her savings to buy a tablet. The ratio of their savings then changed to 3 : 5. How many euros did Ria have before buying the tablet?

A 192 B 200 C 250 D 400 E 420

23. A chess tournament is planned for teams, each of which has exactly three players. Each player in a team will play exactly once against each player from all the other teams. For organisational reasons, no more than 250 games can be played in total. At most, how many teams can enter the tournament?

A 11 B 10 C 9 D 8 E 7

24. The diagram shows the square $WXYZ$. The points P, Q and R are the midpoints of the sides ZW, XY and YZ respectively. What fraction of the square $WXYZ$ is shaded?



A $\frac{3}{4}$ B $\frac{5}{8}$ C $\frac{1}{2}$ D $\frac{7}{16}$ E $\frac{3}{8}$

25. A train is made up of 18 carriages. There are 700 passengers travelling on the train. In any block of five adjacent carriages, there are 199 passengers in total. How many passengers in total are in the middle two carriages of the train?

A 70 B 77 C 78 D 96 E 103

