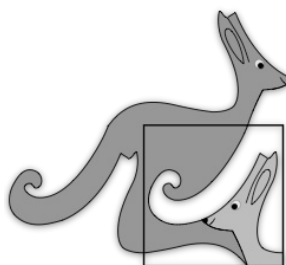


United Kingdom
Mathematics Trust



GREY KANGAROO

Thursday 17 March 2022

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a member of the Association Kangourou sans Frontières

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MARKETS

*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:

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☎ 0113 365 1121

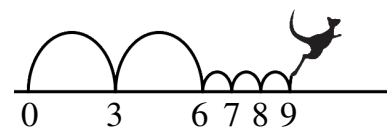
challenges@ukmt.org.uk

www.ukmt.org.uk

1. Beate rearranges the five numbered pieces shown to display the smallest possible nine-digit number. Which piece does she place at the right-hand end?

A B C D E

2. Kanga likes jumping on the number line. She always makes two large jumps of length 3, followed by three small jumps of length 1, as shown, and then repeats this over and over again. She starts jumping at 0.



Which of these numbers will Kanga land on?

A 82

B 83

C 84

D 85

E 86

3. The front number plate of Max's car fell off. He put it back upside down but luckily this didn't make any difference. Which of the following could be Max's number plate?

A B C D E

4. In the equation on the right there are five empty squares. Sanja wants to fill four of them with plus signs and one with a minus sign so that the equation is correct.

$$6 \square 9 \square 12 \square 15 \square 18 \square 21 = 45$$

Where should she place the minus sign?

A Between 6 and 9

B Between 9 and 12

C Between 12 and 15

D Between 15 and 18

E Between 18 and 21

5. There are five big trees and three paths in a park. It has been decided to plant a sixth tree so that there are the same number of trees on either side of each path. In which region of the park should the sixth tree be planted?

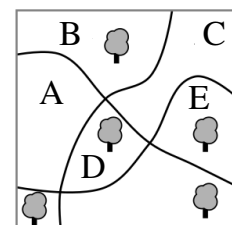
A

B

C

D

E



6. How many positive integers between 100 and 300 have only odd digits?

A 25

B 50

C 75

D 100

E 150

7. On a standard dice, the sum of the numbers of pips on opposite faces is always 7. Four standard dice are glued together as shown. What is the minimum number of pips that could lie on the whole surface?

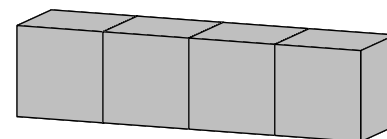
A 52



B 54

C 56

D 58

E 60



8. Tony the gardener planted tulips  and daisies  in a square flowerbed of side-length 12 m, arranged as shown.

What is the total area, in m^2 , of the regions in which he planted daisies?

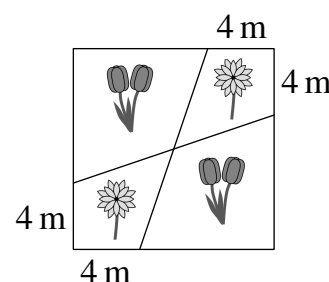
A 48

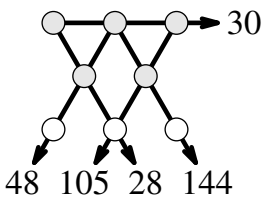
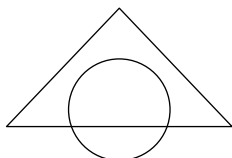
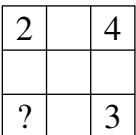
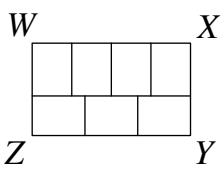
B 46

C 44

D 40

E 36



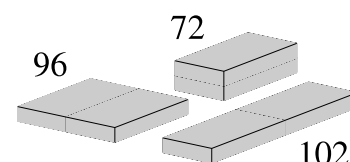
9. Three sisters, whose average age is 10, all have different ages. The average age of one pair of the sisters is 11, while the average age of a different pair is 12. What is the age of the eldest sister?
- A 10 B 11 C 12 D 14 E 16
10. In my office there are two digital 24-hour clocks. One clock gains one minute every hour and the other loses two minutes every hour. Yesterday I set both of them to the same time but when I looked at them today, I saw that the time shown on one was 11:00 and the time on the other was 12:00. What time was it when I set the two clocks?
- A 23:00 B 19:40 C 15:40 D 14:00 E 11:20
11. Werner wrote a list of numbers with sum 22 on a piece of paper. Ria then subtracted each of Werner's numbers from 7 and wrote down her answers. The sum of Ria's numbers was 34. How many numbers did Werner write down?
- A 7 B 8 C 9 D 10 E 11
12. The numbers 1 to 8 are to be placed, one per circle, in the circles shown. The number next to each arrow shows what the product of the numbers in the circles on that straight line should be. What will be the sum of the numbers in the three circles at the bottom of the diagram?
- 
- A 11 B 12 C 15 D 16 E 17
13. The area of the intersection of a triangle and a circle is 45% of the total area of the diagram. The area of the triangle outside the circle is 40% of the total area of the diagram. What percentage of the circle lies outside the triangle?
- 
- A 20% B 25% C 30% D $33\frac{1}{3}\%$ E 35%
14. Jenny decided to enter numbers into the cells of a 3×3 table so that the sum of the numbers in all four possible 2×2 cells will be the same. The numbers in three of the corner cells have already been written, as shown. Which number should she write in the fourth corner cell?
- 
- A 0 B 1 C 4 D 5 E 6
15. The villages P , Q , R and S are situated, not necessarily in that order, on a long straight road. The distance from P to R is 75 km, the distance from Q to S is 45 km and the distance from Q to R is 20 km. Which of the following could **not** be the distance, in km, from P to S ?
- A 10 B 50 C 80 D 100 E 140
16. The large rectangle $WXYZ$ is divided into seven identical rectangles, as shown. What is the ratio $WX : XY$?
- 
- A 3 : 2 B 4 : 3 C 8 : 5 D 12 : 7 E 7 : 3
17. You can choose four positive integers X , Y , Z and W . What is the maximum number of odd numbers you can obtain from the six sums $X + Y$, $X + Z$, $X + W$, $Y + Z$, $Y + W$ and $Z + W$?
- A 2 B 3 C 4 D 5 E 6

18. Marc always cycles at the same speed and he always walks at the same speed. He can cover the round trip from his home to school and back again in 20 minutes when he cycles and in 60 minutes when he walks. Yesterday Marc started cycling to school but stopped and left his bike at Eva's house on the way before finishing his journey on foot. On the way back, he walked to Eva's house, collected his bike and then cycled the rest of the way home. His total travel time was 52 minutes.

What fraction of his journey did Marc make by bike?

- A $\frac{1}{6}$ B $\frac{1}{5}$ C $\frac{1}{4}$ D $\frac{1}{3}$ E $\frac{1}{2}$

19. A builder has two identical bricks. She places them side by side in three different ways, as shown. The surface areas of the three shapes obtained are 72, 96 and 102.



What is the surface area of the original brick?

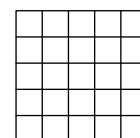
- A 36 B 48 C 52 D 54 E 60

20. Carl wrote a list of 10 distinct positive integers on a board. Each integer in the list, apart from the first, is a multiple of the previous integer. The last of the 10 integers is between 600 and 1000. What is this last integer?

- A 640 B 729 C 768 D 840 E 990

21. What is the smallest number of cells that need to be coloured in a 5×5 square grid so that every 1×4 or 4×1 rectangle in the grid has at least one coloured cell?

- A 5 B 6 C 7 D 8 E 9



22. Mowgli asked a snake and a tiger what day it was. The snake always lies on Monday, Tuesday and Wednesday but tells the truth otherwise. The tiger always lies on Thursday, Friday and Saturday but tells the truth otherwise. The snake said "Yesterday was one of my lying days". The tiger also said "Yesterday was one of my lying days". What day of the week was it?

- A Thursday B Friday C Saturday D Sunday E Monday

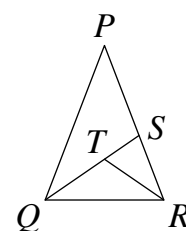
23. Several points were marked on a line. Renard then marked another point between each pair of adjacent points on the line. He performed this process a total of four times. There were then 225 points marked on the line. How many points were marked on the line initially?

- A 15 B 16 C 20 D 25 E 30

24. An isosceles triangle PQR , in which $PQ = PR$, is split into three separate isosceles triangles, as shown, so that $PS = SQ$, $RT = RS$ and $QT = RT$.

What is the size, in degrees, of angle QPR ?

- A 24 B 28 C 30 D 35 E 36



25. There are 2022 kangaroos and some koalas living across seven parks. In each park, the number of kangaroos is equal to the total number of koalas in all the other parks.

How many koalas live in the seven parks in total?

- A 288 B 337 C 576 D 674 E 2022