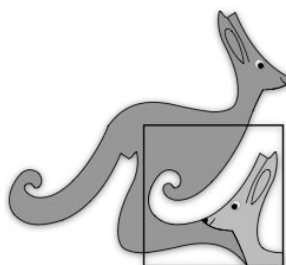


United Kingdom
Mathematics Trust



PINK KANGAROO

18 – 19 March 2021

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MARKETS

England & Wales: Year 11 or below

Scotland: S4 or below

Northern Ireland: Year 12 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 Pink Kangaroo should be sent to:

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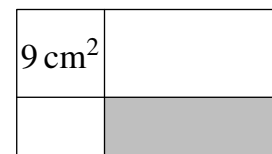
enquiry@ukmt.org.uk

www.ukmt.org.uk

1. The mean age of the members of a jazz band is 21. The saxophonist, singer and trumpeter are 19, 20 and 21 years old respectively. The other three musicians are all the same age. How old are they?

A 21 B 22 C 23 D 24 E 26

2. A rectangle with perimeter 30 cm is divided by two lines, forming a square of area 9 cm^2 , as shown in the figure.



What is the perimeter of the shaded rectangle?

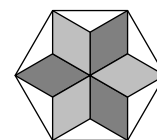
A 14 cm B 16 cm C 18 cm D 21 cm E 24 cm

3. The number x has the following property: subtracting $\frac{1}{10}$ from x gives the same result as multiplying x by $\frac{1}{10}$. What is the number x ?

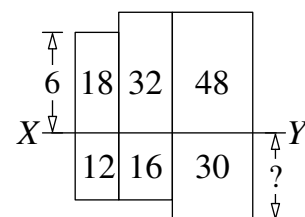
A $\frac{1}{100}$ B $\frac{1}{11}$ C $\frac{1}{10}$ D $\frac{11}{100}$ E $\frac{1}{9}$

4. Six congruent rhombuses, each of area 5 cm^2 , form a star. The tips of the star are joined to draw a regular hexagon, as shown. What is the area of the hexagon?

A 36 cm^2 B 40 cm^2 C 45 cm^2 D 48 cm^2 E 60 cm^2



5. Six rectangles are arranged as shown. The number inside each rectangle gives the area, in cm^2 , of that rectangle. The rectangle on the top left has height 6 cm.



What is the height of the bottom right rectangle?

A 4 cm B 5 cm C 6 cm D 7.5 cm E 10 cm

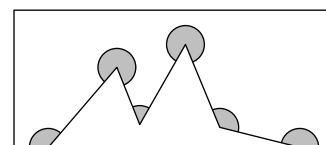
6. How many five-digit positive integers have the product of their digits equal to 1000?

A 10 B 20 C 28 D 32 E 40

7. Five line segments are drawn inside a rectangle as shown.

What is the sum of the six marked angles?

A 360° B 720° C 900° D 1080° E 1120°

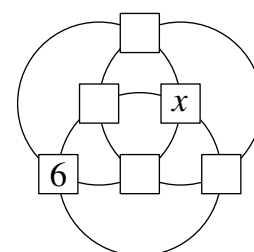


8. At half-time in a handball match, the home team was losing 9–14 to the visiting team. However, in the second half, the home team scored twice as many goals as the visitors and won by one goal. What was the full-time score?

A 20–19 B 21–20 C 22–21 D 23–22 E 24–23

9. The numbers from 1 to 6 are to be placed at the intersections of three circles, one number in each of the six squares. The number 6 is already placed. Which number must replace x , so that the sum of the four numbers on each circle is the same?

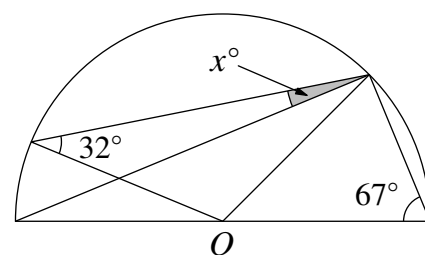
A 1 B 2 C 3 D 4 E 5



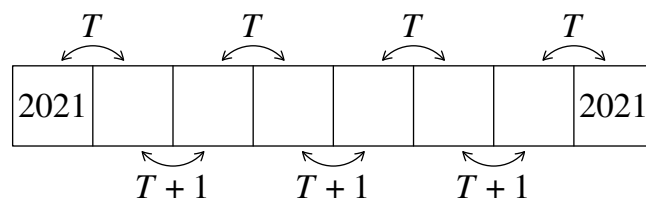
10. Ahmad walks up a flight of eight steps, going up either one or two steps at a time. There is a hole on the sixth step, so he cannot use this step. In how many different ways can Ahmad reach the top step?
- A 6 B 7 C 8 D 9 E 10
11. There were five teams entered in a competition. Each team consisted of either only boys or only girls. The number of team members was 9, 15, 17, 19 and 21. After one team of girls had been knocked out of the competition, the number of girls still competing was three times the number of boys. How many girls were in the team that was eliminated?
- A 9 B 15 C 17 D 19 E 21
12. Tom had ten sparklers of the same size. Each sparkler took 2 minutes to burn down completely. He lit them one at a time, starting each one when the previous one had one tenth of the time left to burn. How long did it take for all ten sparklers to burn down?
- A 18 minutes and 20 seconds B 18 minutes and 12 seconds
C 18 minutes D 17 minutes
E 16 minutes and 40 seconds

13. The diagram shows a semicircle with centre O . Two of the angles are given. What is the value of x ?

A 9 B 11 C 16 D 17.5 E 18



14. Each box in the strip shown is to contain one number. The first box and the eighth box each contain 2021. Numbers in adjacent boxes have sum T or $T + 1$ as shown. What is the value of T ?

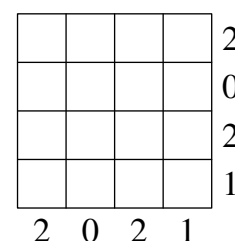


A 4041 B 4042 C 4043 D 4044 E 4045

15. In the 4×4 grid some cells must be painted black. The numbers to the right of the grid and those below the grid show how many cells in that row or column must be black.

In how many ways can this grid be painted?

A 1 B 2 C 3
D 5 E more than 5



16. Five girls ran a race. Fiona started first, followed by Gertrude, then Hannah, then India and lastly Janice. Whenever a girl overtook another girl, she was awarded a point. India was first to finish, then Gertrude, then Fiona, then Janice and lastly Hannah.

What is the lowest total number of points that could have been awarded?

A 9 B 8 C 7 D 6 E 5

17. The number 2021 has a remainder of 5 when divided by 6, by 7, by 8, or by 9.
How many positive integers are there, smaller than 2021, that have this property?

A 4 B 3 C 2 D 1 E none

18. Tatiana's teacher drew a 3×3 grid on the board, with zero in each cell. The students then took turns to pick a 2×2 square of four adjacent cells, and to add 1 to each of the numbers in the four cells. After a while, the grid looked like the diagram on the right (some of the numbers in the cells have been rubbed out.)

0	0	0	●	18	●
0	0	0	●	47	●
0	0	0	13	●	?

What number should be in the cell with the question mark?

A 9 B 16 C 21 D 29 E 34

19. Three boys played a "Word" game in which they each wrote down ten words. For each word a boy wrote, he scored three points if neither of the other boys had the same word; he scored one point if only one of the other boys had the same word. No points were awarded for words which all three boys had. When they added up their scores, they found that they each had different scores. Sam had the smallest score (19 points), and James scored the most. How many points did James score?

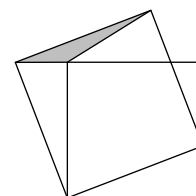
A 20 B 21 C 23 D 24 E 25

20. Let N be the smallest positive integer such that the sum of its digits is 2021.
What is the sum of the digits of $N + 2021$?

A 10 B 12 C 19 D 28 E 2021

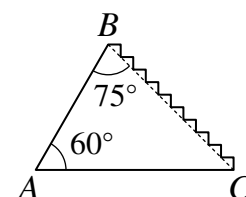
21. The smaller square in the picture has area 16 and the grey triangle has area 1.
What is the area of the larger square?

A 17 B 18 C 19 D 20 E 21



22. A caterpillar crawled up a smooth slope from A to B , and crept down the stairs from B to C . What is the ratio of the distance the caterpillar travelled from B to C to the distance it travelled from A to B ?

A 1:1 B 2:1 C 3:1 D $\sqrt{2} : 1$ E $\sqrt{3} : 1$



23. A total of 2021 balls are arranged in a row and are numbered from 1 to 2021. Each ball is coloured in one of four colours: green, red, yellow or blue. Among any five consecutive balls there is exactly one red, one yellow and one blue ball. After any red ball the next ball is yellow. The balls numbered 2 and 20 are both green. What colour is the ball numbered 2021?

A Green B Red C Yellow D Blue
E It is impossible to determine

24. Each of the numbers m and n is the square of an integer. The difference $m - n$ is a prime number.
Which of the following could be n ?

A 100 B 144 C 256 D 900 E 10000

25. Christina has eight coins whose weights in grams are different positive integers. When Christina puts any two coins in one pan of her balance scales and any two in the other pan of the balance scales, the side containing the heaviest of those four coins is always the heavier side.

What is the smallest possible weight of the heaviest of the eight coins?

A 8

B 12

C 34

D 55

E 256