



Junior Mathematical Challenge

Thursday 25 April 2024

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*England & Wales: Year 8 or below
Scotland: S2 or below
Northern Ireland: Year 9 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 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, or 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.
There is no penalty for giving an incorrect answer.
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 markings even if they are in the wrong places. If you mark the sheet in the wrong place, doodle, 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.
9. To accommodate candidates sitting at other times, please do not discuss the paper on the internet until **08:00 BST on Saturday 27 April**, when the solutions video will be released at ukmt.org.uk/competition-papers. Candidates in time zones more than 5 hours ahead of GMT must sit the paper on Friday 26 April (as defined locally).

1. When the five expressions below are simplified, how many different values are obtained?

$2 + 2$	2×2	$2 - 2$	$2 \div 2$	2^2
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- A 1 B 2 C 3 D 4 E 5

2. Which of the following could have a capacity of 10 litres?

- A An aeroplane B A bucket C A cup D A dustpan E An egg

3. Gill is 36 this year. In which year will her age next be a square?

- A 2025 B 2037 C 2047 D 2052 E 2060

4. A drink is made by mixing one part of cordial with four parts of water. What percentage of the drink is cordial?

- A 20 B 25 C 40 D 75 E 80

5. What is the value of $1 + 2 - 3 \times 4 \div 5$?

- A 0.2 B 0.3 C 0.4 D 0.5 E 0.6

6. Which of the following has the same remainder when divided by 3 as it does when divided by 4?

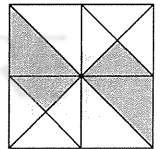
- A 7 B 11 C 17 D 19 E 25

7. The diagram shows a large square which has been divided into four smaller squares.

It also shows both diagonals of the large square and two diagonals of smaller squares.

What fraction of the area of the large square has been shaded?

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



8. Skye has half as many pens as Ishaa. Ana has twice as many pens as Skye.

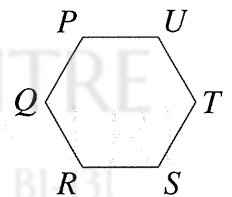
What fraction of all their pens does Skye have?

- A $\frac{1}{3}$ B $\frac{1}{4}$ C $\frac{1}{5}$ D $\frac{1}{6}$ E $\frac{1}{8}$

9. The diagram shows the regular hexagon $PQRSTU$.

What is the size of angle UPT ?

- A 30° B 45° C 60° D 120° E 150°



10. In Fred's field there are some humans and some horses.

There are 25 heads in total and 60 legs in total.

What is the difference between the number of humans and the number of horses?

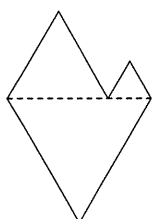
- A 3 B 7 C 9 D 11 E 15

11. A hexagon is formed by arranging three equilateral triangles, as shown in the diagram.

The side-length of the largest equilateral triangle is 10 cm.

What is the perimeter, in cm, of the hexagon?

- A 45 B 40 C 35 D 30
E more information needed



12. In the multiplication sum shown, y represents the same digit each time.
What is the value of y ?

A 0

B 1

C 4

D 5

E 6

$$\begin{array}{r} 3y \\ \times 4yy \\ \hline 1y77y \end{array}$$

13. In the triangle PQR , the point S is on the edge QR .
 $\angle QPS = \angle SPR$, $PQ = PS = SR$ and $\angle PRQ = x^\circ$.
What is the value of x ?

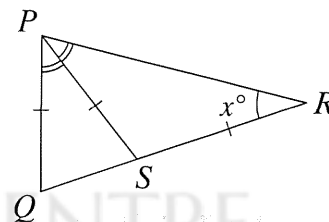
A 30

B 33

C 36

D 40

E 45



14.

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The digits 1, 2, 3, 5 and 8 are to be placed in the grid above, one to a cell, to make a correct mathematical statement. Which number should come immediately after the division sign?

A 1

B 2

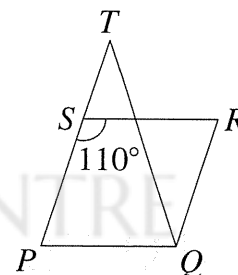
C 3

D 5

E 8

15. In the diagram shown, $PQRS$ is a rhombus and PQT is an isosceles triangle in which $PT = QT$. Angle $PSR = 110^\circ$.

What is the size of angle SQT ?

A 5° B 10° C 12.5° D 15° E 20° 

16. The world's smallest vertebrate is much shorter than its name! Discovered in 2022, the frog *paedophryne amauensis* is only 7.7 mm long.

Approximately how many of these frogs, placed end to end, would be needed to make a line 1 metre long?

A 100

B 130

C 260

D 390

E 520

17. $PQRS$ is a square with area 100 cm^2 . The point T is inside the square.
 QRT is a triangle with area 24 cm^2 .

What is the area, in cm^2 , of the triangle PTS ?

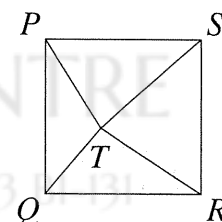
A 24

B 25

C 26

D 27

E 28



18. Goldilocks eats three equal-sized bowls of porridge, one after the other. When she has eaten $\frac{3}{7}$ of the total amount of porridge, what fraction of the porridge in the second bowl has she eaten?

A $\frac{2}{63}$ B $\frac{1}{7}$ C $\frac{1}{3}$ D $\frac{2}{7}$ E $\frac{1}{2}$

19. Jokers always lie.

Clowns always tell the truth.

A group of four, each of whom is a Joker or a Clown, make the following statements about each other:

P says, "Q always lies";

Q says, "R always lies";

R says, "P always tells the truth";

S says, "Exactly two of P, Q and R are Jokers".

How many of P, Q, R and S are Clowns?

A 0

B 1

C 2

D 3

E 4

20. When you cut a regular hexagon into two pieces with a single straight cut, you get two polygons. Which of these shapes cannot be obtained?

A A triangle

B A quadrilateral

C A pentagon

D A heptagon

E An octagon

21. The rectangle $PQRS$ is divided into eight squares: one large unshaded square, four small unshaded squares and three shaded squares, as shown in the diagram. What fraction of the area of rectangle $PQRS$ is shaded?

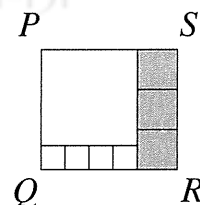
A $\frac{1}{5}$

B $\frac{5}{17}$

C $\frac{2}{7}$

D $\frac{3}{10}$

E $\frac{1}{3}$



22. Forty furry ferrets weigh the same as fifty fit ferrets. Forty-five fit ferrets weigh the same as fifty-four friendly ferrets. How many friendly ferrets weigh the same as fifty furry ferrets?

A 40

B 55

C 60

D 75

E 80

23. The area of a square is six times the area of a rectangle with a length half that of the square and a width 6 cm less than the width of the square. What is the perimeter of the square?

A 24 cm

B 28 cm

C 32 cm

D 36 cm

E 40 cm

24. Rovers, United, City and Wanderers played against each other once in a hockey tournament.

The results table is shown on the right:

Team	Win	Draw	Loss	Goals for	Goals against
Rovers	3	0	0	5	0
United	0	2	1	3	6
City	1	1	1	4	4
Wanderers	0	1	2	0	2

What was the score in the match between Rovers and United?

A 3 - 1

B 3 - 0

C 2 - 1

D 2 - 0

E 1 - 0

25. In a school, one fifth of the students have blue eyes. One tenth of the left-handed students have blue eyes. One quarter of the right-handed students have blue eyes. What fraction of the students are left-handed?

A $\frac{1}{3}$

B $\frac{1}{4}$

C $\frac{1}{5}$

D $\frac{1}{8}$

E $\frac{1}{10}$