

United Kingdom
Mathematics Trust

JUNIOR MATHEMATICAL CHALLENGE

Wednesday 26 April 2023

© 2023 UK Mathematics Trust

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 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.
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 Junior Mathematical Challenge should be sent to:

challenges@ukmt.org.uk

www.ukmt.org.uk

1. What is the value of $3202 - 2023$?

- A 821 B 1001 C 1179 D 1221 E 1279

2. How many of the following five options are factors of 30?

- A 1 B 2 C 3 D 4 E 5

3. What is the value of $\frac{1+2+3+4+5}{6+7+8+9+10}$?

- A $\frac{1}{2}$ B $\frac{3}{8}$ C $\frac{7}{16}$ D $\frac{9}{20}$ E $\frac{1}{3}$

4. One of these is the largest two-digit positive integer that is divisible by the product of its digits. Which is it?

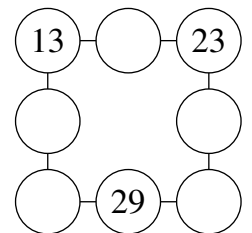
- A 12 B 24 C 36 D 72 E 96

5. The record for travelling 100m on a skateboard by a dog is 19.65 seconds. This was achieved by Jumpy in 2013. What was Jumpy's approximate average speed?

- A 0.2 m/s B 0.5 m/s C 2 m/s D 2.5 m/s E 5 m/s

6. When this prime number square is completed, the eight circles contain eight different primes, and each of the four sides has total 43. What is the sum of the five missing primes?

- A 51 B 53 C 55 D 57 E 59



7. What is the difference between the largest two-digit multiple of 2 and the smallest three-digit multiple of 3?

- A 5 B 4 C 3 D 2 E 1

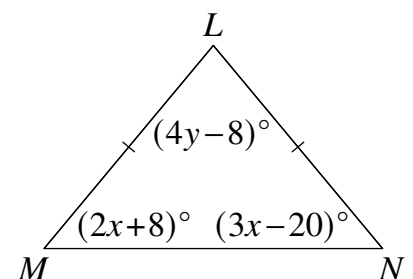
8. How many of these six numbers are prime?

$0^2 + 1^2$	$1^2 + 2^2$	$2^2 + 3^2$	$3^2 + 4^2$	$4^2 + 5^2$	$5^2 + 6^2$
A 1	B 2	C 3	D 4	E 5	

9. Triangle LMN is isosceles with $LM = LN$.

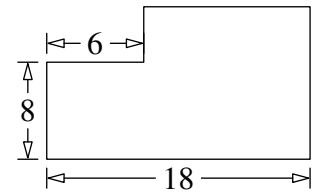
What is the value of y ?

- A 15 B 17 C 19 D 21 E 23



10. In the diagram, all distances shown are in cm. The perimeter of the shape is 60 cm. What is the area, in cm^2 , of the shape?

- A 192 B 204 C 212 D 232 E 252



11. To save money, Scrooge is reusing tea bags. After a first ‘decent’ cup of tea, he dries the bag and uses two such dried bags to make a new ‘decent’ cup of tea. These bags are then dried again and four such bags now make a ‘decent’ cup of tea. After that they are put on the compost heap.

How many ‘decent’ cups of tea can Scrooge get out of a new box of 120 tea bags?

- A 480 B 240 C 210 D 195 E 180

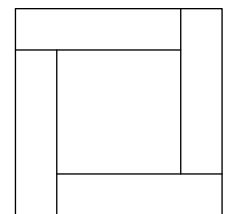
12. One afternoon, Brian the snail went for a slither at a constant speed. By 1:50 pm he had slithered 150 centimetres. By 2:10 pm he had slithered 210 centimetres. When did Brian start his slither?

- A Noon B 12:20 pm C 12:30 pm D 12:45 pm E 1 pm

13. Four congruent rectangles are arranged as shown to form an inner square of area 20 cm^2 and an outer square of area 64 cm^2 .

What is the perimeter of one of the four congruent rectangles?

- A 6 cm B 8 cm C 9.75 cm D 16 cm E 20 cm



14. In the addition shown, x and y represent different single digits.

What is the value of $x + y$?

- A 10 B 11 C 12 D 13 E 14

$$\begin{array}{r} 77x \\ 6yx \\ + yyx \\ \hline 1xxx7 \end{array}$$

15. My train was scheduled to leave at 17:48 and to arrive at my destination at 18:25. However, it started four minutes late, and the journey took twice as long as scheduled.

When did I arrive?

- A 19:39 B 19:06 C 19:02 D 18:29 E 17:52

16. Amrita needs to select a new PIN. She decides it will be made up of four non-zero digits with the following properties:

- i) The first two digits and the last two digits each make up a two-digit number which is a multiple of 11.
- ii) The sum of all the digits is a multiple of 11.

How many different possibilities are there for Amrita’s PIN?

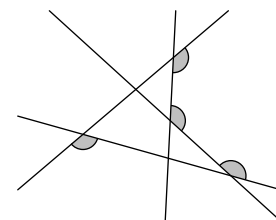
- A 1 B 2 C 4 D 8 E 16

17. Two numbers p and q are such that $0 < p < q < 1$.

Which is the largest of these expressions?

- A $q - p$ B $p - q$ C $\frac{p + q}{2}$ D $\frac{p}{q}$ E $\frac{q}{p}$

18. What is the sum of the four marked angles in the diagram?



- A 540° B 560° C 570° D 600° E 720°

19. In a football match, Rangers beat Rovers 5 – 4. The only time Rangers were ahead was after they scored the final goal. How many possible half-time scores were there?

- A 9 B 10 C 15 D 16 E 25

20. Each cell in the crossnumber is to be filled with a single digit.

Across	Down
1. A cube	1. A prime
2. A square	

1	
2	

Which of these could be the sum of the four digits in the crossnumber?

- A 17 B 16 C 15 D 14 E 13

21. Eleanor’s Elephant Emporium has four types of elephant. There are twice as many grey elephants as pygmy elephants, three times as many white elephants as grey elephants and four times as many pink elephants as white elephants. There are 20 more white elephants than pygmy elephants.

How many elephants are in Eleanor’s Emporium?

- A 123 B 132 C 213 D 231 E 312

22. The positive integers from 1 to 9 inclusive are placed in the grid, one to a cell, so that the product of the three numbers in each row or column is as shown.

What number should be placed in the bottom right-hand cell?

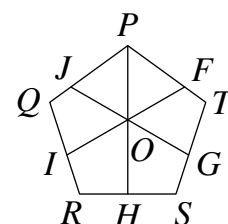
- A 9 B 6 C 4 D 3 E 2

			18
			105
		?	192
			56 180 36

23. Regular pentagon $PQRST$ has centre O . Lines PH , FI and GJ go through O . The six angles at O are equal.

What is the size of angle TGO ?

- A 60° B 72° C 75° D 76° E 78°



24. Beatrix was born in this century. On her birthday this year, her age was equal to the sum of the digits of the year in which she was born. In which of these years will her age on her birthday be twice the sum of the digits of that year?

- A 2027 B 2029 C 2031 D 2033 E 2035

25. Granny gave away her entire collection of antique spoons to three people. Her daughter received 8 more than a third of the total; her son received 8 more than a third of what was then left; finally her neighbour received 8 more than a third of what was then left.

What is the sum of the digits of the number of spoons which were in Granny’s collection?

- A 14 B 12 C 10 D 8 E 6