United Kingdom
Mathematics Trust

JUNIOR MATHEMATICAL CHALLENGE

Wednesday 27 and Thursday 28 April 2022

© 2022 UK Mathematics Trust

supported by [XTX] MARKETS Overleaf

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:

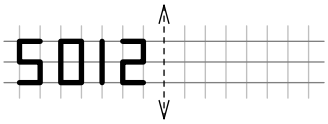
UK Mathematics Trust, 84/85 *Pure Offices,* 4100 *Park Approach Leeds, LS*15 8*GB*

☎ +44 (0) 113 365 1121 challenges@ukmt.org.uk www.ukmt.org.uk

1. Which of these has the greatest value?

A $20+22$ B $202+2$ C 202×2 D $2\times 0\times 2\times 2$ E 20×22

2. The number 5012 is reflected in the mirror-line shown.
Onto which number is it reflected?



A 5102 B 2015 C 5012 D 2105 E 5105

3. Think of any number. Add five; multiply by two; add ten; divide by two; subtract your original number; add three. What is the resulting number?

A 10 B 11 C 12 D 13 E 14

4. What is the value of $0.6+\dfrac{2}{5}$?

A 0.15 B 0.24 C 0.8 D 1 E 2.4

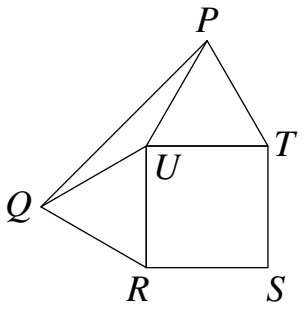
5. How many of the following take integer values?

$$\frac{1}{1} \quad \frac{11}{1+1} \quad \frac{111}{1+1+1} \quad \frac{1111}{1+1+1+1} \quad \frac{11\,111}{1+1+1+1+1}$$

A 0 B 1 C 2 D 3 E 4

6. The diagram shows the square $RSTU$ and two equilateral triangles, PUT and QRU.

What is the size of angle QPU?



A 10° B 15° C 20° D 25° E 30°

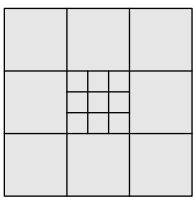
7. Kiwi fruit contain roughly two and a half times as much vitamin C as the same weight of oranges. What weight of kiwi fruit contains approximately the same amount of vitamin C as 1 kg of oranges?

A 100 g B 200 g C 250 g D 400 g E 550 g

8. Today is Thursday. What day will it be in 100 days' time?

A Tuesday B Wednesday C Thursday D Friday E Saturday

9. How many squares of any size can be seen in the diagram?



A 25 B 27 C 28 D 39 E 40

10. Half of a quarter of an eighth of a number is equal to $\dfrac{1}{2}+\dfrac{1}{4}+\dfrac{1}{8}$.
What is the number?

A 14 B 28 C 42 D 56 E 64

© 2022 UK Mathematics Trust

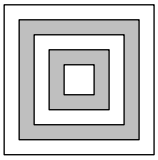
11. Nine of the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 are to be put in two groups so that the sum of the numbers in each group is a multiple of four.
What is the largest number that could be left out?

A 3 B 4 C 5 D 6 E 7

12. When my pot of paint is half full, it weighs 5.8 kg. When my pot of paint is one quarter full, it weighs 3.1 kg. What is the weight of the full pot?

A 8.9 kg B 11.2 kg C 11.6 kg D 12 kg E 12.4 kg

13. The diagram shows five squares whose side-lengths, in cm, are 1, 2, 3, 4 and 5.
What percentage of the area of the outer square is shaded?



A 25% B 30% C 36% D 40% E 42%

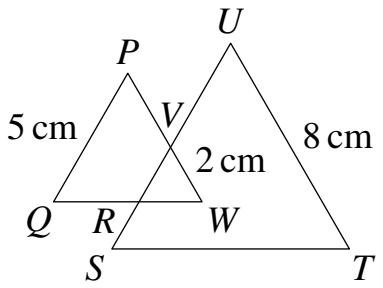
14. A group of children stand evenly spaced around a circular ring and are numbered consecutively 1, 2, 3, and so on. Number 13 is directly opposite number 35. How many children are there in the ring?

A 42 B 44 C 46 D 48 E 50

15. What is the value of $2 \div (4 \div (6 \div (8 \div 10)))$?

A $\frac{1}{960}$ B $\frac{1}{5}$ C $\frac{3}{8}$ D $\frac{1}{2}$ E $\frac{15}{4}$

16. The diagram shows a seven-sided polygon, $PQRSTUV$. It is formed from two equilateral triangles PQW and STU of side-length 5 cm and 8 cm respectively. The two triangles overlap in an equilateral triangle of side-length 2 cm.
What is the perimeter of $PQRSTUV$?

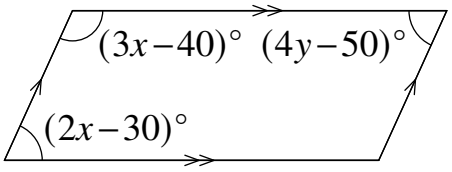


A 27 cm B 30 cm C 33 cm D 36 cm
E 39 cm

17. Amrita and Beatrix play a game in which each player starts with 10 counters. In each round of the game, one player wins and is given 3 counters; and her opponent has 1 counter removed. At the end of the game, Amrita and Beatrix have 40 counters and 16 counters respectively.
How many rounds of the game did Amrita win?

A 10 B 11 C 12 D 13 E 14

18. The diagram shows a parallelogram.
What is the value of y?



A 22 B 24 C 25 D 28 E 30

19. At the start of the day I had three times as many apples as pears. By the end of the day, after eating five apples but no pears, I had twice as many pears as apples.
How many pieces of fruit did I have at the start of the day?

A 4 B 8 C 12 D 16 E 20

© 2022 UK Mathematics Trust

20. During a particularly troublesome lesson, the following conversation occurs:
Pam: "I always tell the truth." Quentin: "Pam is lying."
Roger: "Both Pam and Quentin are lying." Susan: "Everyone is lying."
Terry: "Everyone is telling the truth."

How many people are telling the truth?

A 0 B 1 C 2 D 3 E 4

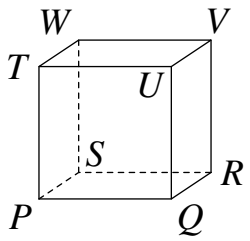
21. Two lists of numbers are as shown below.

List S:	3	5	8	11	13	14
List T:	2	5	6	10	12	13

Jenny decided she would move one number from List S to List T and one number from List T to List S so that the sum of the numbers in the new List S is equal to the sum of the numbers in the new List T. In how many ways could she do this?

A 1 B 2 C 3 D 4 E 5

22. A triangular pyramid with vertices T, U, V and Q is removed from the solid cube shown.
How many edges does the remaining solid have?



A 4 B 6 C 8 D 10 E 12

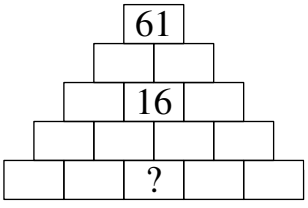
23. The price of a train ticket increased by 5% and then decreased by 20% in a special offer. It was then £4 less expensive than its original price. What was the original price of the ticket?

A £8.60 B £13 C £20.40 D £25 E £26.40

24. Flori's Flower shop contains fewer than 150 flowers. All the flowers are purple, yellow, red or white. The ratio of purple flowers to yellow flowers is 1 : 2, the ratio of yellow flowers to red flowers is 3 : 4 and the ratio of red flowers to white flowers is 5 : 6.
How many flowers are there in Flori's shop?

A 133 B 136 C 139 D 142 E 145

25. In the number pyramid shown, each cell above the bottom row contains the sum of the numbers in the two cells immediately below it. The sum of the numbers in the bottom row is 17.
What is the central number of the bottom row?



A 2 B 3 C 4 D 5 E 6

© 2022 UK Mathematics Trust