

UK JUNIOR MATHEMATICAL CHALLENGE

TUESDAY 27TH APRIL 1999

Organised by the **United Kingdom Mathematics Trust**
from the **School of Mathematics, University of Leeds**



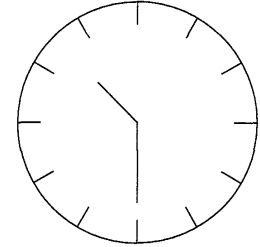
RULES AND GUIDELINES (to be read before starting)

1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England and Wales must be in School Year 8 or below.
Candidates in Scotland must be in S2 or below.
Candidates in Northern Ireland must be in School Year 9 or below.
5. **Use B or HB pencil only**. 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.
6. *Do not expect to finish the whole paper in 1 hour*. Concentrate first on Questions 1-15.
When you have checked your answers to these, have a go at some of the later questions.
7. Five marks are awarded for each correct answer to Questions 1-15.
Six marks are awarded for each correct answer to Questions 16-25.
Each incorrect answer to Questions 16-20 loses 1 mark.
Each incorrect answer to Questions 21-25 loses 2 marks.
8. Your Answer Sheet will be read only by a *dumb machine*. **Do not write or doodle on the sheet except to mark your chosen options**. The machine 'sees' 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 rubber stuck to the page, the machine will 'see' a mark and interpret this mark in its own way.
9. The questions on this paper challenge you to **think**, not to guess. You get more marks, and more satisfaction, by doing one question carefully than by guessing lots of answers.
The UK JMC is about solving interesting problems, not about lucky guessing.

1. What is two and thirty-four hundredths when written as a decimal?
A 0.234 B 2.034 C 2.34 D 234.00 E 23400

2. Roughly how much is 200ml?
A a thimbleful B a spoonful C a cupful D a saucepanful E a bucketful

3. A wall clock (with hour marks, but no numbers) shows the time as half past ten. If the clock is seen reflected in a vertical mirror, what time would it appear to show?
A half past one B 4 o'clock C 2:30
D eight hundred hours E just gone 7 minutes past six



4. What is the remainder when 7 000 010 is divided by 7?
A 1 B 2 C 3 D 4 E 5

5. For £2, a stamp machine gives a mixture of 20p and 26p stamps worth a total of £2.02. How many 20p stamps are included?
A 1 B 3 C 5 D 8 E 10

6. What is the value of $19 + 99 + 19 \times 99$?
A 236 B 1999 C 11701 D 13563 E none of these

7. Mary has three brothers and four sisters. If they, and Mary, all buy each other an Easter egg, how many eggs will be bought?
A 14 B 28 C 42 D 56 E 64

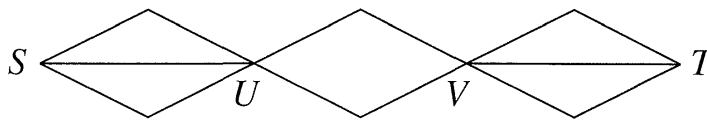
8. I owe fifty-five people £55 each. In my piggy bank I have fifty £50 notes and five £5 notes. Is this enough to pay all my debts?
A Yes, exactly right B Yes, with a few pounds to spare C Yes, with lots left over
D No, a few pounds too little E No, far too little

9. A “double-decker” sandwich has three slices of bread and two layers of filling (bread/filling/bread/filling/bread). Each slice of bread has to be buttered on each side that is in contact with the filling. I make as many of these sandwiches as possible from a sliced loaf which has 22 usable slices, excluding the crusts which are not used. How many sides of bread do I have to butter?
A 21 B 22 C 28 D 32 E 42

10. On a journey a certain weight of luggage is carried free, but there is a charge of £10 per kilogram for any additional luggage above this weight. Laa-laa's luggage, which weighs a total of 50kg, is overweight and she is charged £150. If Po's luggage weighs a total of 30kg, what will she have to pay?
A £0 B £30 C £50 D £90 E £100

11. What is the sum of all the prime numbers which are less than 25?
A 95 B 98 C 100 D 109 E 115

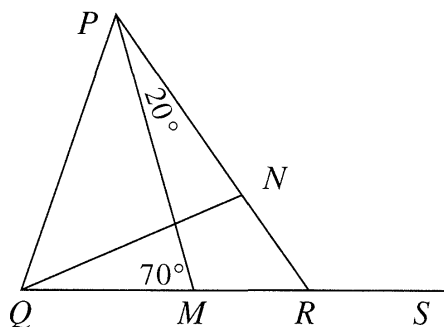
12. How many different routes are there from S to T which do not go through either of the points U and V more than once?



- A 3 B 6 C 8 D 12 E 18

13. In the diagram $\angle RPM = 20^\circ$ and $\angle QMP = 70^\circ$. What is $\angle PRS$?

- A 90° B 110° C 120°
D 130° E 140°



14. A bottle contains 750ml of mineral water. Rachel drinks 50% more than Ross, and these two friends finish the bottle between them. How much does Rachel drink?

- A 250 ml B 375 ml C 400ml D 450 ml E 500 ml

15. A sheet of graph paper is placed with its x -axis pointing due East and its y -axis pointing due North. A sluggish snail starts at point $(0,0)$ and slowly, but smoothly, slithers 1 unit North, 2 units East, 3 units South, 4 units West, 5 units North, 6 units East, 7 units South, 8 units West, 9 units North and (lastly!) 10 units East. At which point does the snail finally arrive?

- A $(-6, 5)$ B $(5, 6)$ C $(6, 5)$ D $(6, -5)$ E $(-4, 5)$

16. I have some strange dice: the faces show the numbers 1 to 6 as usual, except that the odd numbers are negative (i.e. $-1, -3, -5$ in place of $1, 3, 5$). If I throw two such dice, which total cannot be achieved?

- A 3 B 4 C 5 D 7 E 8

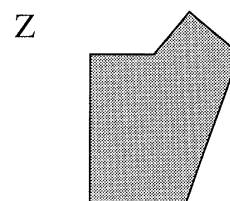
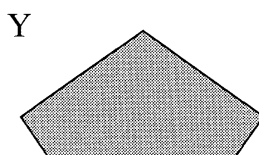
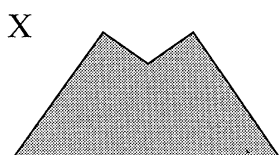
17. The 8-digit number $1234*678$ is a multiple of 11. Which digit is represented by $*$?

- A 1 B 3 C 5 D 7 E 9

18. Using all of the digits from 1 to 9 inclusive, Shahb wrote down a fraction which had four digits in the numerator and five digits in the denominator. He then noticed that the fraction simplified to give exactly one half. Which of the following could have been the numerator of Shahb's fraction?

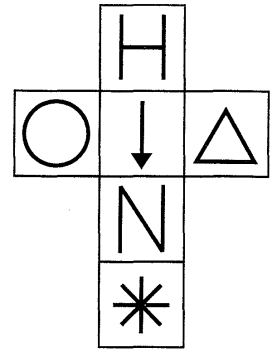
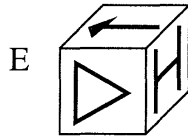
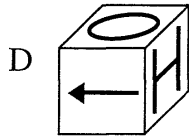
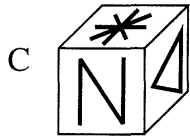
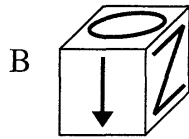
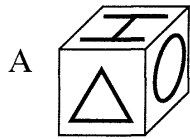
- A 5314 B 6729 C 7341 D 7629 E 8359

19. Three shapes X, Y and Z are shown below. A sheet of A4 paper (297 mm by 210 mm) is folded **once**, and placed flat on a table. Which of these shapes could be made?



- A Y and Z only B Z and X only C X and Y only D none of them E all of them

20. Which of the cubes below could have been made by folding the net on the right?



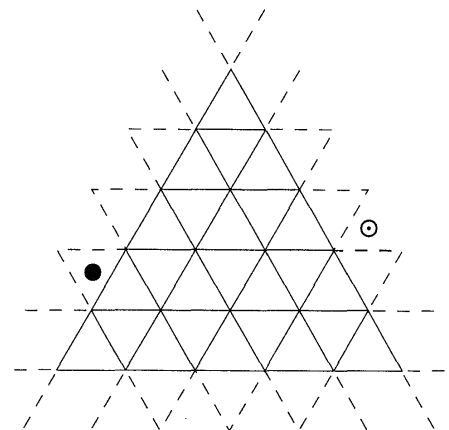
21. Granny says “I am 84 years old – not counting my Sundays”. How old is she really?

- A 90 B 91 C 96 D 98 E 99

22. How many times between midday and midnight is the hour hand of a clock at right angles to the minute hand?

- A 11 B 12 C 20 D 22 E 24

23. In the game illustrated here, the black counter • has to be moved from its “starting position” to its “target position” (shown here as circle ⊙). The aim is to achieve this in the smallest number of “moves”. To make a “move”, you have to choose one of the fifteen marked lines as your “mirror” and move the counter • to the position which is the reflection of its present position in that “mirror”. What is the smallest number of “moves” required to reach the target position?



- A 2 B 3 C 4 D 5
E Starting from • it is impossible to reach ⊙

24. Boris, Spike and Percival are going to race up the 99 steps that lead from the beach to the car park at the top of the cliff. Boris can run up five steps in the same time as Spike can run up four steps, which is the same time as Percival can run up three steps. It is agreed that Boris starts from the bottom, Spike starts 21 steps up and Percival 38 steps up. If they all start at the same time, in what order will they reach the top?

- A SBP B SPB C PBS D PSB E BSP

25. The two-digit by two-digit multiplication on the right has lots of gaps, but most of them can be filled in by logic (not by guesswork). Which digit must go in position * ?

- A 1 B 3 C 5 D 7 E 9

