

UK JUNIOR MATHEMATICAL CHALLENGE

TUESDAY 29th APRIL 2003

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.

The UKMT is a registered charity

1. What is half of 199?

- A $94\frac{1}{2}$ B 95 C $95\frac{1}{2}$ D 99 E $99\frac{1}{2}$

2. A comb for horses has 100 teeth, each 1 mm wide. The gaps between the teeth are also 1 mm wide. How long is the comb?

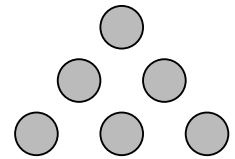


- A 9.9 cm B 10 cm C 19 cm D 19.9 cm E 20 cm

3. Our Geography teacher, Mr Ridge, takes 7 minutes to mark each pupil's test. He has a class of 32. How many minutes marking will he save if 9 of the class are absent?

- A 63 B 161 C 224 D 246 E 287

4. Sam has six plain-coloured plates hanging on her lounge wall, in the formation shown. What is the smallest number of plates that need to be moved to turn this formation upside down?

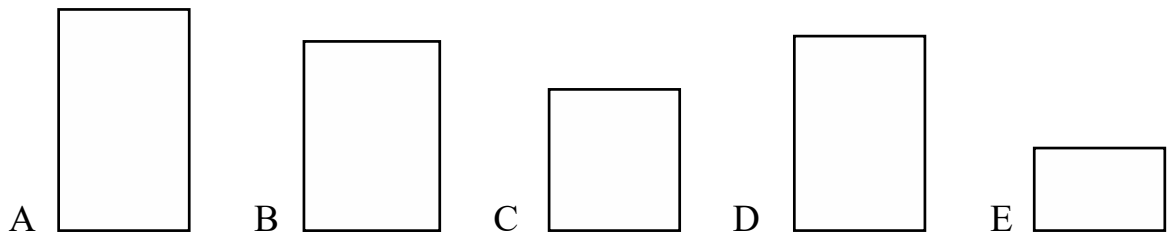


- A 1 B 2 C 3 D 4 E 5

5. Yesterday, the reading on Granny's electricity meter was 098657. She was shocked to realise that all six of these digits are different. How many more units of electricity will she use before the next time all the digits are different?

- A 1 B 4 C 14 D 55 E 3688

6. Referring to the rectangles below, the largest is red and the smallest is blue. Orange is the same size as yellow and not next to blue. Which is orange?



7. In California, a bottle of orange juice costs \$3, but when you return the bottle you get \$2 back. What is the largest number of bottles of juice you can buy if you start with \$10?

- A 3 B 6 C 8 D 9 E 10

8. I saw the following numbers on cars on the way to school. Each number, with one exception, has the same remainder when divided by 9. Which is the exception?

- A 113 B 257 C 554 D 725 E 861

9. The mean age of the four members of 'All Sinners' boy band is 19. What is the mean age when an extra member who is 24 years old joins them?

- A 19 B 20 C 21 D 22 E 24

10. Correct to one decimal place, what is the square root of 18?

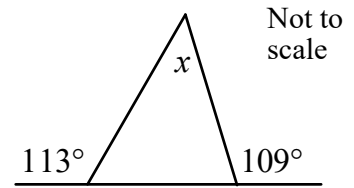
- A 2.6 B 3.0 C 3.6 D 4.2 E 9.0

11. Nicolas wrote a Christmas card for each of his three sisters – Carol, Holly and Ivy – and put each card into a separate envelope. In how many different ways can he send a card to each sister so that none of them receives the correct card?

A 1 B 2 C 3 D 4 E 5

12. What is the size of the angle marked x ?

A 42° B 67° C 69°
 D 71° E 111°



13. This is a prime year, since 2003 is a prime number. In the next ten years there is just one prime year. Which is it?

A 2005 B 2007 C 2009 D 2011 E 2013

14. In the sequence which begins 2, 3, 5, 10, ... each number after the second is the sum of all the previous numbers in the sequence. What is the 10th number in the sequence?

A 47 B 170 C 640 D 1280 E 2560

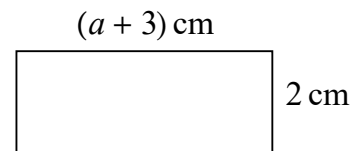
15. It was reported recently that, in an average lifetime of 70 years, each human is likely to swallow about 8 spiders while sleeping. Supposing that the population of the UK is around 60 million, what is the best estimate of the number of unfortunate spiders consumed in this way in the UK each year?

A 50 000 B 600 000 C 7 000 000 D 80 000 000 E 900 000 000

16.
$$\begin{array}{r} A\ 6\ B\ C \\ \times\quad 7 \\ \hline D\ 9\ E\ 9\ 8 \end{array}$$
 In this multiplication each letter stands for a different digit. Which letter stands for 3?

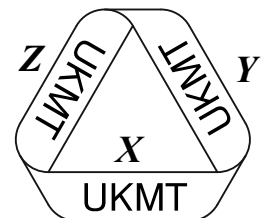
A B C D E

17. A rectangle is formed by doubling both the length and the width of the rectangle shown in the diagram. What is the area, in cm^2 , of this new rectangle?



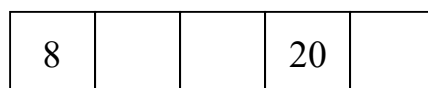
A $2a + 10$ B $4a + 12$ C $4a + 20$ D $8a + 6$ E $8a + 24$

18. The UKMT logo shows a single strip of paper with 'UKMT' in the positions X , Y and Z . Which of these are written on the same side of the paper?



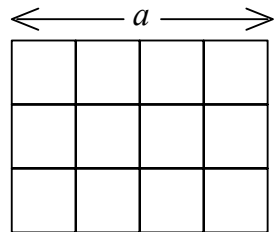
A X and Y B Y and Z C X and Z
 D X , Y and Z E none of them

19. When the diagram below is complete, the number in the middle of each group of 3 adjoining cells is the mean of its two neighbours. What number goes in the right-hand end cell?



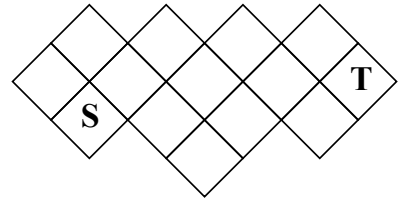
A 12 B 14 C 16 D 24 E 28

20. The diagram shows a rectangular wire grid which forms twelve small squares. The length of the grid is a . What is the total length of wire required to make the grid?



- A $9a$ B $\frac{17a}{2}$ C $\frac{31a}{4}$ D $7a$ E $\frac{13a}{2}$

21. The board for the game *Rorrim* is shown. In the game, a counter has to be moved from the starting square, **S**, to the target square, **T**, in the smallest possible number of moves. To make a move, one of the lines of the board is chosen as a mirror and the counter is moved to the square which is the reflection of its present square in that mirror. What is the smallest number of moves required to reach square **T** from square **S**?



- A 3 B 4 C 5 D 6 E 7

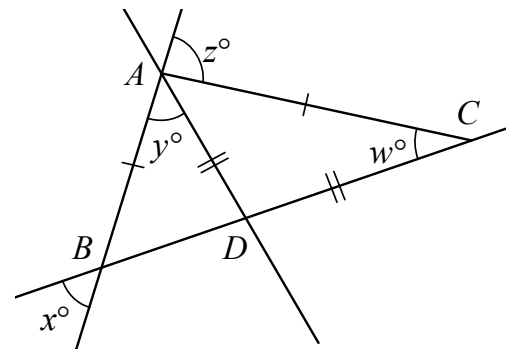
22. Two builders, Bob and Geri, buy bricks at the same price. Bob sells 10 for £6 and Geri sells 12 for £7. Supposing they sell equal numbers of bricks, what number has each sold when Bob has gained £4 more than Geri?

- A 42 B 60 C 72 D 120 E 240

23. In the diagram alongside, $AB = AC$ and $AD = CD$. How many of the following statements are true for the angles marked?

$w = x$ $x + y + z = 180$ $z = 2x$

- A all of them B two C one
D none of them E it depends on x



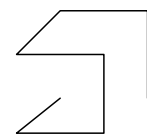
24. Gill has recently moved to a new house, which has a three-digit number. The sum of this number and its three individual digits is 429. What is the *product* of the three digits which make up the house number?

- A 20 B 28 C 30 D 36 E 48

25. A cardboard cube is cut along its edges by a cut following the line shown in the diagram.

The cube is then opened out and placed flat on a table.

Which of the following could be the resulting shape?



- A B C
D E