

UK JUNIOR MATHEMATICAL CHALLENGE

TUESDAY 1ST MAY 2001

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.

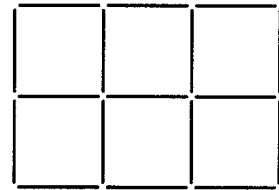
The UKMT is a registered charity

1. Last Saturday, each half of a hockey match lasted 40 minutes and the half-time interval was a quarter of an hour. The match started at 2:30 pm. At what time did it finish?

- A 3:10 pm B 3:25 pm C 3:50 pm D 3:55 pm E 4:05 pm

2. The diagram shows 6 small squares made with matchsticks. How many matchsticks must be removed to leave precisely 3 small squares which touch only at corners?

- A 3 B 4 C 5 D 6 E 7



3. The theme music for the famous science-fiction film *2001: A Space Odyssey* is taken from *Also Sprach Zarathustra*, which was written by Richard Strauss in 1896. How many years was that before the film itself was produced in 1968?

- A 72 B 33 C 28 D 105 E 82

4. What is 40% of 50% of £60?

- A £7 B £8 C £12 D £15 E £20

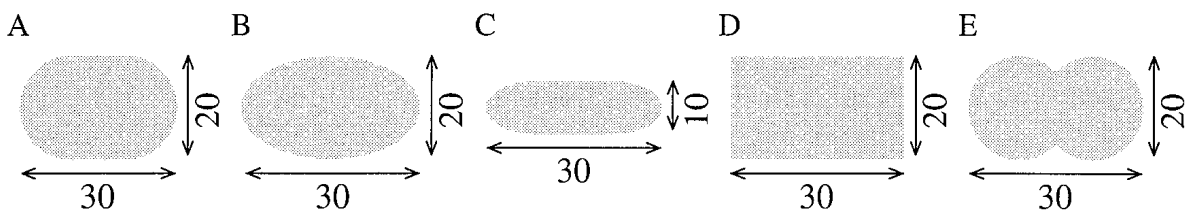
5. A 'Supertape' plays for 6 hours. It rewinds 18 times as quickly as it plays. How many minutes does it take to rewind a Supertape completely?

- A 3 B 18 C 20 D 108 E 180

6. Last year, to help sell his house, Southampton butcher Simon Broadribb offered to give the buyer meat worth £20 every week for one year. It was stated that this could be either 40 burgers, or 96 sausages, or 140 rashers of bacon, or 30 lamb cutlets, or 35 portions of mince. Based on that offer, which is the most expensive?

- A a burger B a sausage C a rasher of bacon
D a lamb cutlet E a portion of mince

7. A guinea-pig in a large field is tethered to one end of a 10 metre rope. The other end of the rope is attached to a ring which is free to slide along a fixed horizontal rail, 10 metres long, in the middle of the field. Which diagram shows the shape of the part of the field that the guinea-pig can reach?

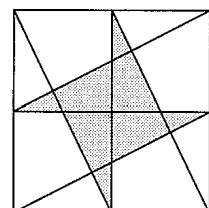


8. What is the difference between the largest and smallest of the following numbers?

- A 0.89 B 0.9 C 0.17 D 0.72 E 0.73

9. In the diagram, a corner of the shaded star is at the midpoint of each side of the large square. What fraction of the large square is covered by the star?

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



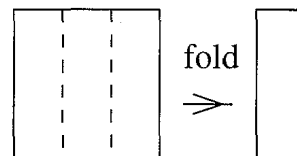
10. If the digit 4 is replaced by the digit 3 in each of the numbers below, which number is reduced by the largest amount?

- A 45678 B 87654 C 95400 D 74000 E 99949

11. At half time in a netball match, Jokers were leading Jesters by 3 goals to 2. Seven goals were scored in the second half. Which of the following could *not* have been the result of the match?

- A The match was drawn B Jesters won by 2 goals C Jesters won by 4 goals
D Jokers won by 2 goals E Jokers won by 3 goals

12. The sheet of paper shown on the left is folded along the dotted lines (each fold being either forwards or backwards) to make the leaflet shown on the right. Each of the six 'pages' of the leaflet is printed in a different colour. No matter how it is folded, the leaflet will have two pages visible on the outside. How many different pairs of outside pages can be obtained by folding the sheet of paper in different ways?

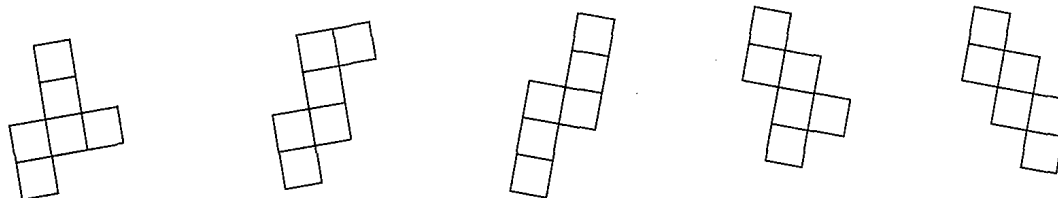


- A 4 B 6 C 9 D 12 E 15

13. A newspaper reported last year that marine experts at the Sea Life Centre in Brighton were teaching an octopus to open jam jars to get at food as a way of stopping it becoming bored. Assuming that it can open four jars simultaneously and that each jar takes 30 seconds to open, how many jars can the octopus open per hour?

- A 30 B 120 C 240 D 480 E 960

14. How many of the following nets could be folded to make a cube?



- A 1 B 2 C 3 D 4 E 5

15. It is well known that the Pobble has no toes, and that the three-toed sloth has 12 toes (3 on each of its 4 feet). A synchronised swimming team is made up of 7 Pobbles and 5 three-toed sloths. What is the mean number of toes per team member?

- A 3 B 4 C 5 D 6 E 7

16. My bus fare is 44p. If the driver can give me change, what is the smallest number of coins which must change hands when I pay this fare?

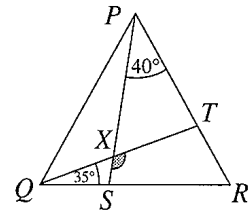
- A 2 B 3 C 4 D 5 E 6

17. Lollipops cost 12p each, but I get 3 for 30p. What is the maximum number of lollipops I can buy if I have £2 to spend?

- A 16 B 17 C 18 D 19 E 20

18. Triangle PQR is equilateral. Angle $SPR = 40^\circ$, angle $TQR = 35^\circ$.
What is the size of the marked angle SXT ?

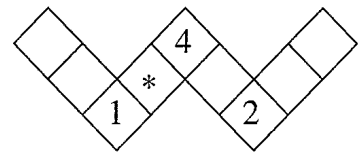
A 140° B 135° C 120° D 105° E 75°



19. Given that $\frac{1}{12} + \frac{1}{24} = \frac{1}{x}$, what is the value of x ?

A $\frac{1}{18}$ B $\frac{1}{8}$ C 8 D 18 E 36

20. The numbers from 1 to 9 inclusive are to be placed, one number to a square, in the figure shown, so that the total of the three numbers in each of the four lines is the same. What number should replace *?

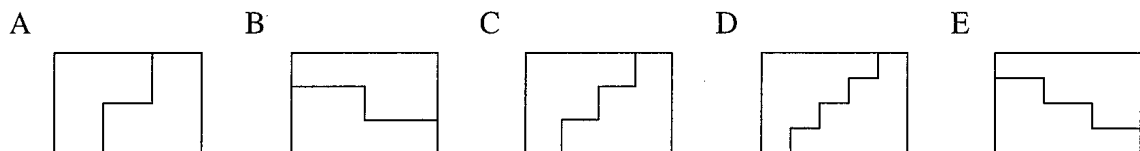


A 5 B 6 C 7 D 8 E 9

21. What is the value of $2^8 \div 8^2$?

A $\frac{1}{4}$ B $\frac{1}{2}$ C 1 D 2 E 4

22. A rectangular piece of card measuring 30 cm by 24 cm is cut into two equal pieces which can be reassembled to form another rectangle measuring 18 cm by 40 cm. Which diagram shows the original rectangle and the cut?



23. Granny tells Dilly that her glove drawer contains 1 left-hand blue glove, 2 left-hand green gloves, 3 right-hand blue gloves, and 4 right-hand green gloves, and asks her to bring a pair of gloves from the drawer. Unfortunately Dilly cannot tell the difference between left-hand and right-hand gloves, but, thankfully, can identify blue and green. What is the smallest number of gloves that Dilly should bring, in order to be sure that these include a matching pair?

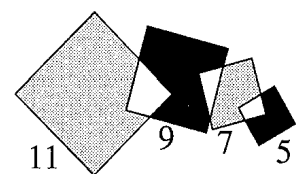
A 2 B 4 C 6 D 8 E 10

24. To celebrate this year, 2001, a square pavement is made using equal sized square tiles, coloured either red or blue. In the pattern all the tiles are red apart from those along the two main diagonals, which are made using a total of 2001 blue tiles. How many red tiles are needed?

A 1 000 000 B 996 000 C 250 000 D 1 002 001 E 4 002 000

25. The diagram shows four overlapping squares which have sides 5, 7, 9 and 11. What is the difference between the total area shaded grey and the total area shaded black?

A 25 B 36 C 49 D 64



E more information needed