

## UK JUNIOR MATHEMATICAL CHALLENGE

TUESDAY 1ST MAY 2001

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



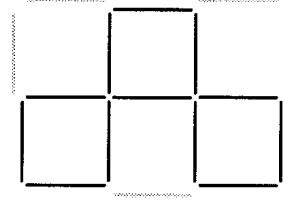
## SOLUTIONS LEAFLET

This solutions leaflet for the JMC is sent in the hope that it might provide all concerned with some alternative solutions to the ones they have obtained. It is not intended to be definitive. The organisers would be very pleased to receive alternatives created by candidates.

**The UKMT is a registered charity**

1. E The match lasted 95 minutes, i.e. 1 hour 35 minutes.

2. C There are 17 matches in the diagram. Three squares which meet only at corners will require 12 matches. Hence removing 5 matchsticks will achieve a suitable arrangement, such as that shown in the diagram.



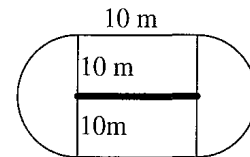
3. A It was 72 years from 1896 to 1968.

4. C 50% of £60 = £30; 40% of £30 = £12.

5. C One eighteenth of 6 hours is one third of one hour, i.e. 20 minutes.

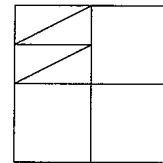
6. D As each offer of meat is worth the same amount, the most expensive individual item corresponds to the offer with the least number of items, i.e. a lamb cutlet.

7. A The diagram shows that the shape which the guinea-pig can reach is composed of a 10m × 20m rectangle and two semicircles of radius 10m whose centres are the ends of the bar.



8. E The largest number is 0.9 and the smallest 0.17; their difference is 0.73.

9. B The star may be considered to be composed of four congruent right-angled triangles. The diagram shows that these may be arranged to fill one quarter of the large square completely.



10. A The number which will be reduced by the largest amount is that in which the digit 4 represents the greatest value. In the given numbers, the digit 4 represents 40000, 4, 400, 4000 and 40 respectively.

11. E In total, twelve goals were scored in the match. Therefore a winning margin of three goals is impossible since it would require one team to score an even number of goals and the other team an odd number. Results A to D could occur if the number of goals scored by Jokors and Jesters in the second half were, respectively, 3 and 4; 2 and 5; 1 and 6; 4 and 3.

12. B For each of the six colours, the leaflet may be folded in two different ways in which that particular colour is one of the two outside pages. This suggests that there are 12 different pairs of outside pages, but each possible pair has been counted twice in this calculation and hence there are six different pairs of outside pages.

13. D The octopus is able to open 8 jars per minute, so the number opened per hour is  $60 \times 8 = 480$ .

14. E Try it for yourself!

15. C The total number of toes per team is  $5 \times 12 = 60$ . There are 12 members in a team, so the mean number of toes per team member is  $\frac{60}{12} = 5$ .

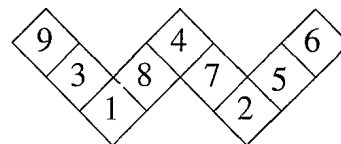
16. **B** If I pay the exact fare, the smallest number of coins I could use is 4 ( $2 \times 20\text{p}$  and  $2 \times 2\text{p}$ ). If I receive change, then it is not possible for only 2 coins to change hands since this would involve my giving the driver one coin (50p, £1 or £2) and receiving only one coin in change, but the necessary coin does not exist. However, if I give the driver a 50p coin and receive a 5p coin and a 1p coin in change, then only 3 coins change hands.

17. **D** I can buy 18 (i.e.  $6 \times 3$ ) lollipops for £1.80, leaving an additional 20p, with which I can buy one more lollipop.

18. **B** Triangle  $PQR$  is equilateral; hence  $\angle PRS = 60^\circ$  and therefore  $\angle XSQ = 40^\circ + 60^\circ = 100^\circ$  (exterior angle of a triangle is equal to the sum of the two interior opposite angles). Hence, applying this result again, we deduce that  $\angle SXT = (35 + 100)^\circ = 135^\circ$ .

19. **C**  $\frac{1}{12} + \frac{1}{24} = \frac{2 + 1}{24} = \frac{3}{24} = \frac{1}{8}$ . Therefore  $x = 8$ .

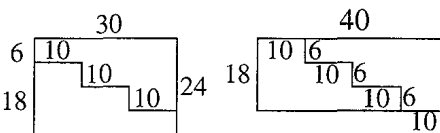
20. **D** The sum of the numbers from 1 to 9 inclusive is 45. As 1, 2 and 4 are each included in two of the lines, the sum of the individual totals of the four lines is  $45 + 1 + 2 + 4 = 52$ . Hence the total of the three numbers in each line is  $\frac{52}{4} = 13$ , so the \* should be replaced by 8.



One possible solution is shown on the right.

21. **E** The values of  $2^8$  and  $8^2$  are 256 and 64 respectively and  $256 \div 64 = 4$ . Alternatively:  $2^8 \div 8^2 = 2^8 \div (2^3)^2 = 2^8 \div 2^6 = 2^2 = 4$ .

22. **E** The length of the rectangle is to be increased by one third, whilst its height is to be decreased by one quarter. The cut in diagram E accomplishes this, as the diagram shows.



23. **B** If Dilly brings two green gloves they will not necessarily be a matching pair since they could both be left-hand gloves or both be right-hand gloves and, similarly, two blue gloves could both be right-hand gloves. In the same way, three blue (or green) gloves could all be right-handed. However, if Dilly brings all four blue gloves then these will include a matching pair.

24. **A** As the total number of squares in the two main diagonals is odd, the number of squares along each side of the pavement must also be odd. Let this number be  $n$ ; there are  $n$  squares along each of the two main diagonals, but, as  $n$  is odd, one of these squares forms part of both diagonals and hence the total number of squares along the two main diagonals is  $2n - 1$ . Therefore  $2n - 1 = 2001$  i.e.  $n = 1001$ . Hence the required number of red tiles is  $1001^2 - 2001 = 1\,000\,000$ .

25. **D** The combined grey and white areas form a square of side 11 and a square of side 7, a total area of 170. Similarly, the combined black and white areas form a square of side 9 and a square of side 5, a total area of 106. As the white area is included in both these totals, the difference between the totals will be the difference between the grey area and the black area. Hence the correct answer is  $170 - 106 = 64$ .