

## UK JUNIOR MATHEMATICAL CHALLENGE

THURSDAY 30th APRIL 2009

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

**The Actuarial Profession**

making financial sense of the future

### **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.

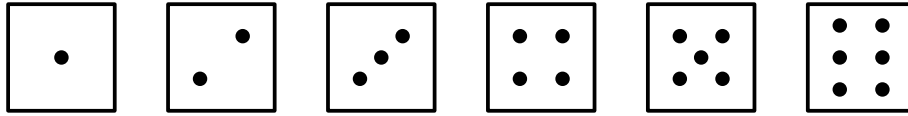
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*<http://www.ukmt.org.uk>*

1. What is the value of  $9002 - 2009$ ?

- A 9336                  B 6993                  C 6339                  D 3996                  E 3669

2. How many of the six faces of a die (shown below) have fewer than three lines of symmetry?



- A 2                          B 3                          C 4                          D 5                          E 6

3. Which of the following is correct?

- A  $0 \times 9 + 9 \times 0 = 9$                   B  $1 \times 8 + 8 \times 1 = 18$                   C  $2 \times 7 + 7 \times 2 = 27$   
 D  $3 \times 6 + 6 \times 3 = 36$                   E  $4 \times 5 + 5 \times 4 = 45$

4. Which of the following points is *not* at a distance of 1 unit from the origin?

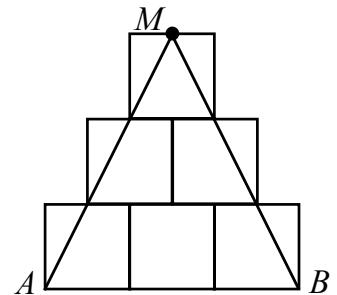
- A (0, 1)                  B (1, 0)                  C (0, -1)                  D (-1, 0)                  E (1, 1)

5. Which of the following numbers is divisible by 7?

- A 111                  B 1111                  C 11 111                  D 111 111                  E 1 111 111

6. Each square in the figure is 1 unit by 1 unit. What is the area of triangle  $ABM$  (in square units)?

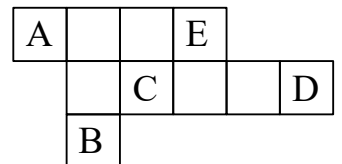
- A 4                  B 4.5                  C 5                  D 5.5                  E 6



7. How many minutes are there from 11:11 until 23:23 on the same day?

- A 12                  B 720                  C 732                  D 1212                  E 7212

8. The figure on the right shows an arrangement of ten square tiles. Which labelled tile could be removed, but still leave the length of the perimeter unchanged?



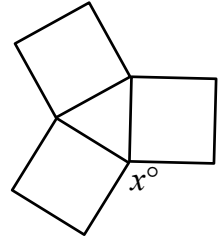
- A                  B                  C                  D                  E

9. How many different digits appear when  $\frac{20}{11}$  is written as a recurring decimal?

- A 2                  B 3                  C 4                  D 5                  E 6

10. The diagram shows three squares of the same size. What is the value of  $x$ ?

A 105    B 120    C 135    D 150    E 165



11. In a sequence of numbers, each term after the first three terms is the sum of the previous three terms. The first three terms are  $-3, 0, 2$ . Which is the first term to exceed 100?

A 11th term    B 12th term    C 13th term    D 14th term    E 15th term

12. Gill is 21 this year. At the famous visit to the clinic in 1988, her weight was calculated to be 5kg, but she now weighs 50kg. What has been the percentage increase in Gill's weight from 1988 to 2009?

A 900%    B 1000%    C 5000%    D 9000%    E 10 000%

13. The sum of ten consecutive integers is 5. What is the largest of these integers?

A 2    B 3    C 4    D 5    E more information needed

14. Karen was given a mark of 72 for Mayhematics. Her average mark for Mayhematics and Mathemagics was 78. What was her mark for Mathemagics?

A 66    B 75    C 78    D 82    E 84

15. In Matt's pocket there are 8 watermelon jellybeans, 4 vanilla jellybeans and 4 butter popcorn jellybeans. What is the smallest number of jellybeans he must take out of his pocket to be certain that he takes at least one of each flavour?

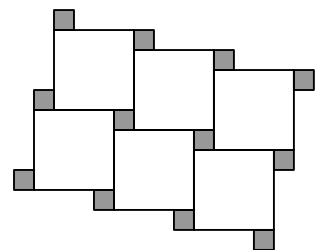
A 3    B 4    C 8    D 9    E 13

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16. The kettle in Keith's kitchen is 80% full. After 20% of the water in it has been poured out, there are 1152 ml of water left. What volume of water does Keith's kitchen kettle hold when it is full?

A 1400 ml    B 1600 ml    C 1700 ml    D 1800 ml    E 2000 ml

17. The tiling pattern shown uses two sizes of square, with sides of length 1 and 4. A very large number of these squares is used to tile an enormous floor in this pattern. Which of the following is closest to the ratio of the number of grey tiles on the floor to the number of white tiles?

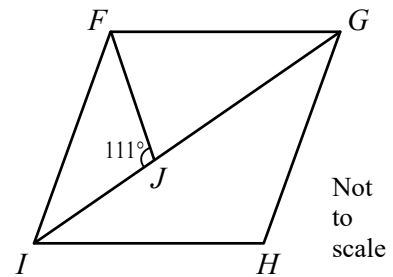
A 1:1    B 4:3    C 3:2    D 2:1    E 4:1



18. Six friends are having dinner together in their local restaurant. The first eats there every day, the second eats there every other day, the third eats there every third day, the fourth eats there every fourth day, the fifth eats there every fifth day and the sixth eats there every sixth day. They agree to have a party the next time they all eat together there. In how many days' time is the party?

A 30 days    B 60 days    C 90 days    D 120 days    E 360 days

19. The diagram on the right shows a rhombus  $FGHI$  and an isosceles triangle  $FGJ$  in which  $GF = GJ$ . Angle  $FJI = 111^\circ$ .



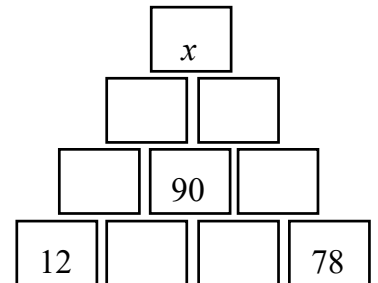
What is the size of angle  $JFI$ ?

- A  $27^\circ$    B  $29^\circ$    C  $31^\circ$    D  $33^\circ$    E  $34\frac{1}{2}^\circ$

20. In the diagram on the right, the number in each box is obtained by adding the numbers in the two boxes immediately underneath.

What is the value of  $x$ ?

- A 300                      B 320                      C 340  
D 360                      E more information needed



21. A rectangular sheet of paper is divided into two pieces by a single straight cut. One of the pieces is then further divided into two, also by a single straight cut. Which of the following could *not* be the total number of edges of the resulting three pieces?

- A 9                      B 10                      C 11                      D 12                      E 13

22. Starting at the square containing the 2, you are allowed to move from one square to the next either across a common edge, or diagonally through a common corner. How many different routes are there passing through exactly two squares containing a 0 and ending in one of the squares containing a 9?

2	0	0	9
0	0	0	9
0	0	0	9
9	9	9	9

- A 7      B 13      C 15      D 25      E 32

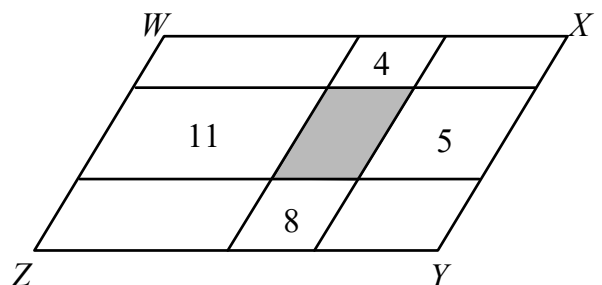
23. The currency used on the planet Zog consists of bank notes of a fixed size differing only in colour. Three green notes and eight blue notes are worth 46 zogs; eight green notes and three blue notes are worth 31 zogs. How many zogs are two green notes and three blue notes worth?

- A 13 zogs      B 16 zogs      C 19 zogs      D 25 zogs      E 27 zogs

24. The parallelogram  $WXYZ$  shown in the diagram on the right has been divided into nine smaller parallelograms. The perimeters, in centimetres, of four of the smaller parallelograms are shown.

The perimeter of  $WXYZ$  is 21 cm.

What is the perimeter of the shaded parallelogram?



- A 5 cm      B 6 cm      C 7 cm      D 8 cm      E 9 cm

25. In Miss Quaffley's class, one third of the pupils bring a teddy bear to school. Last term, each boy took 12 books out of the library, each girl took 17 books and each teddy bear took 9 books. In total, 305 books were taken out. How many girls are there in Miss Quaffley's class?

- A 4                      B 7                      C 10                      D 13                      E 16