

UK JUNIOR MATHEMATICAL CHALLENGE

TUESDAY 27th APRIL 2004

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



RULES AND GUIDELINES (to be read before starting)

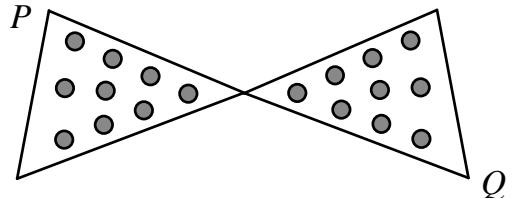
1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England and 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.

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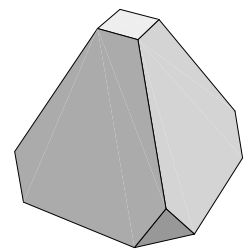
- How many letters of the word **MATHEMATICS** do not have any lines of symmetry?
A 0 B 1 C 2 D 3 E 4
- Which of the following numbers is exactly divisible by 7?
A 104 B 106 C 108 D 110 E 112
- The year 2004 has the units digit equal to twice the thousands digit. How many years will it be before this next happens?
A 10 B 36 C 220 D 1002 E 2004

- A ladybird has landed at point *P* on Sam's bow-tie. If it travels only along the edges of the bow-tie, but cannot travel along any edge more than once, how many different ways are there for it to get from *P* to *Q*?



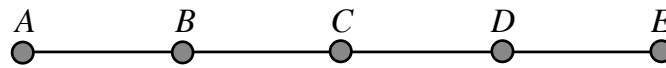
- A 1 B 2 C 3 D 4 E 5
- The word 'thirty' contains 6 letters and $6 = 30 \div 5$. Similarly, the word 'forty' contains 5 letters and $5 = 40 \div 8$. Which of the following is not a multiple of the number of letters it contains?
A six B twelve C eighteen D seventy E ninety
- Which of these fractions is nearest to 1?
A $\frac{12}{23}$ B $\frac{23}{34}$ C $\frac{34}{45}$ D $\frac{45}{56}$ E $\frac{56}{67}$
- In music, a demisemiquaver is half of half of half a crotchet, and there are four crotchets in a semibreve. How many demisemiquavers are there in a semibreve?
A 8 B 16 C 32 D 64 E 128

- A solid square-based pyramid has all of its corners cut off, as shown. How many edges does the resulting shape have?



- A 8 B 13 C 15 D 20 E 24
- The Bean family are very particular about beans. At every meal all Beans eat some beans. Pa Bean always eats more beans than Ma Bean but never eats more than half the beans. Ma Bean always eats the same number of beans as both children together and the two children always eat the same number of beans as each other. At their last meal they ate 23 beans altogether. How many beans did Pa Bean eat?
A 7 B 9 C 11 D 13 E 15
- When Harry bought his train ticket he received £2.50 in change. He noticed that for each coin in his change there was exactly one other coin of the same value. What was the coin of smallest value in Harry's change?
A 2p B 5p C 10p D 20p E 50p

11. The diagram shows a rod with five equally spaced points A , B , C , D and E marked on it.



The rod is rotated three times through 180 degrees, first about A , then about B and finally about E . Which point finishes in the same position as it was at the start?

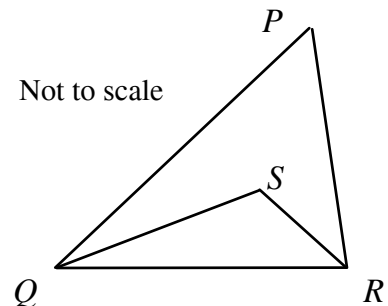
- A A B B C C D D E E

12. The White Rabbit has an appointment to see the Red Queen at 4pm every day apart from weekends. On Monday, he arrives 16 minutes late. Each day after that he hurries more and more and so manages to halve the amount of time that he arrives late each day. On what day of the week does he arrive just 15 seconds late?

- A Monday B Tuesday C Wednesday D Thursday E Friday

13. In the triangle PQR , the angle $QPR = 40^\circ$ and the internal bisectors of the angles at Q and R meet at S , as shown. What is the size of angle QSR ?

- A 110° B 120° C 130° D 135° E 140°



14. The Kings of Clubs, Diamonds, Hearts and Spades, and their respective Queens, are having an arm wrestling competition. Everyone must wrestle everyone else, except that no King will wrestle his own Queen. How many wrestling bouts are there?

- A 12 B 16 C 24 D 28 E 64

15. Granny spends one third of her weekly pension on Thursday night, and one quarter of what remains on Friday. What fraction of the original amount is left for her big night out on Saturday?

- A $\frac{1}{12}$ B $\frac{2}{7}$ C $\frac{5}{12}$ D $\frac{1}{2}$ E $\frac{11}{12}$

16. A robot, which is initially facing North, is programmed to travel 5m then turn through 10° , travel 5m then turn through 20° , travel 5m then turn through 30° , and so on. Each move consists of moving 5m in a straight line and then turning clockwise through an angle which increases by 10° at each move.

How far has it travelled by the time it is first facing due East at the end of a move?

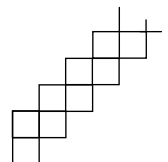
- A 9 m B 40 m C 45 m D 50 m E 90 m

17. Exactly one of these statements is correct. Which one?

- A $44^2 + 77^2 = 4477$ B $55^2 + 66^2 = 5566$ C $66^2 + 55^2 = 6655$
 D $88^2 + 33^2 = 8833$ E $99^2 + 22^2 = 9922$

18. A shape consisting of 2004 small squares is made by continuing the pattern shown in the diagram. The small squares have sides of length 1cm. What is the length, in cm, of the perimeter of the whole shape?

- A 4008 B 4010 C 6012 D 6016 E 8016

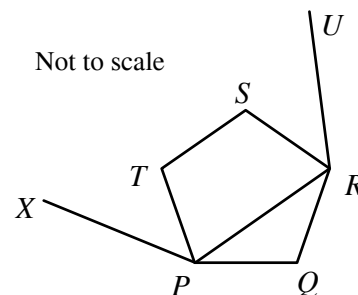


19. If $a \times b = 2$, $b \times c = 24$, $c \times a = 3$ and a , b and c are all positive, what is the value of $a + b + c$?

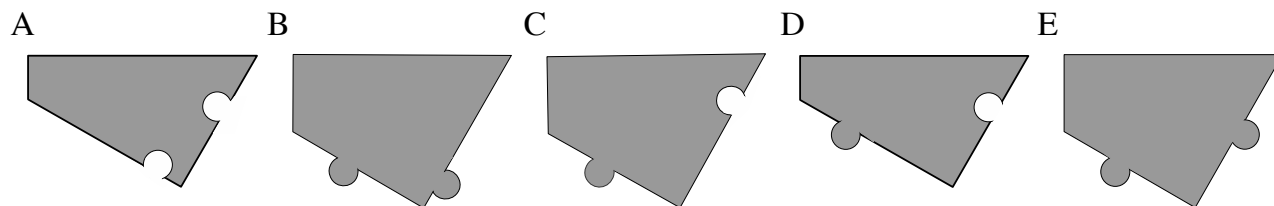
- A $7\frac{1}{2}$ B $10\frac{1}{2}$ C 12 D 16 E 19

20. The figure shows a regular pentagon $PQRST$ together with three sides XP , PR , RU of a regular hexagon with vertices $PRUVWX$. What is the size of angle SRU ?

- A 48° B 54° C 60° D 63° E 72°



21. Four of these jigsaw pieces fit together to form a rectangle. Which one is not used?



22. The digits in the product $13 \times 2 = 26$ can be rearranged to give $16 \times 2 = 32$ as well as $31 \times 2 = 62$. In which one of the following can the digits not be rearranged to give another correct product?

- A $12 \times 3 = 36$ B $12 \times 7 = 84$ C $26 \times 3 = 78$ D $16 \times 3 = 48$ E $39 \times 2 = 78$

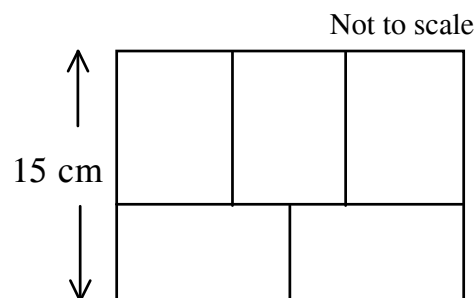
23. In this addition each letter stands for a different digit, with S standing for 3. What is the value of $Y \times O$?

$$\begin{array}{r} S O \\ + M A N Y \\ \hline S U M S \end{array}$$

- A 0 B 2 C 36 D 40 E 42

24. Five identical rectangles fit together as shown. What, in cm^2 , is the total area which they cover?

- A 270 B 300 C 330 D 360 E 450



25. In a sequence of positive integers, every term after the first two terms is the sum of the two previous terms in the sequence. If the fifth term is 2004, what is the maximum possible value of the first term?

- A 399 B 400 C 663 D 999 E 1001