

UK JUNIOR MATHEMATICAL CHALLENGE

THURSDAY 29th APRIL 2010

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)

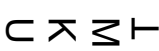
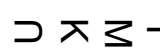
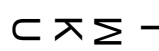
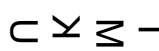
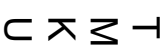
1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England and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

The UKMT is a registered charity

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

1. What is $2010 + (+2010) + (-2010) - (+2010) - (-2010)$?
 A 0 B 2010 C 4020 D 6030 E 8040

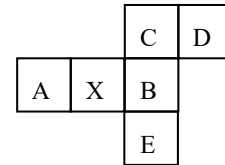
2. Each letter in the abbreviation shown is rotated through 90° clockwise. UKMT
 Which of the following could be the result?

A  B  C  D  E 

3. Which of the following could have a length of 2010 mm?
 A a table B an oil tanker C a teaspoon D a school hall E a hen's egg

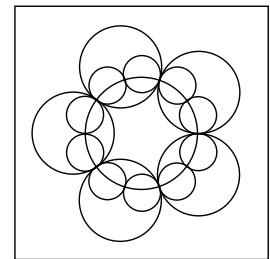
4. If the net shown is folded to make a cube, which letter is opposite X ?

A B C D E



5. The diagram shows a pattern of 16 circles inside a square. The central circle passes through the points where the other circles touch. The circles divide the square into regions. How many regions are there?

A 17 B 26 C 30 D 32 E 38

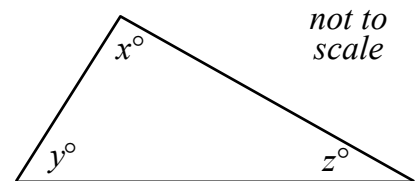


6. Which of the following has the largest value?
 A $6 \div \frac{1}{2}$ B $5 \div \frac{1}{3}$ C $4 \div \frac{1}{4}$ D $3 \div \frac{1}{5}$ E $2 \div \frac{1}{6}$

7. Mr Owens wants to keep the students quiet during a Mathematics lesson. He asks them to multiply all the numbers from 1 to 99 together and then tell him the last-but-one digit of the result. What is the correct answer?
 A 0 B 1 C 2 D 8 E 9

8. In a triangle with angles x° , y° , z° the mean of y and z is x .
 What is the value of x ?

A 90 B 80 C 70 D 60 E 50

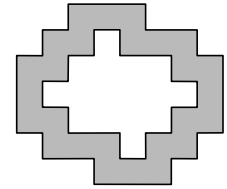


9. Which of the following is the longest period of time?
 A 3002 hours B 125 days C $17\frac{1}{2}$ weeks D 4 months E $\frac{1}{3}$ of a year

10. At the Marldon Apple-Pie-Fayre bake-off, prize money is awarded for 1st, 2nd and 3rd places in the ratio 3 : 2 : 1. Last year Mrs Keat and Mr Jewell shared third prize equally. What fraction of the total prize money did Mrs Keat receive?

A $\frac{1}{4}$ B $\frac{1}{5}$ C $\frac{1}{6}$ D $\frac{1}{10}$ E $\frac{1}{12}$

11. In the diagram shown, all the angles are right angles and all the sides are of length 1 unit, 2 units or 3 units.

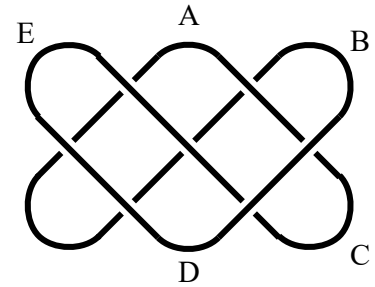


What, in square units, is the area of the shaded region?
 A 22 B 24 C 26 D 28 E 30

12. Sir Lance has a lot of tables and chairs in his house. Each rectangular table seats eight people and each round table seats five people. What is the smallest number of tables he will need to use to seat 35 guests and himself, without any of the seating around these tables remaining unoccupied?

A 4 B 5 C 6 D 7 E 8

13. The diagram shows a Lusona, a sand picture of the Tshokwe people from the West Central Bantu area of Africa. To draw a Lusona the artist uses a stick to draw a single line in the sand, starting and ending in the same place without lifting the stick in between. At which point could this Lusona have started?

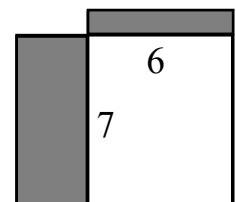


A B C D E

14. The Severn Bridge has carried just over 300 million vehicles since it was opened in 1966. On average, roughly how many vehicles is this per day?

A 600 B 2 000 C 6 000 D 20 000 E 60 000

15. A 6 by 8 and a 7 by 9 rectangle overlap with one corner coinciding as shown.



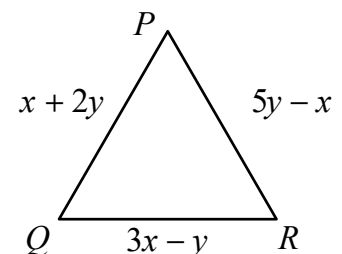
What is the area (in square units) of the region *outside* the overlap?

A 6 B 21 C 27 D 42 E 69

16. One of the examination papers for Amy's Advanced Arithmetic Award was worth 18% of the final total. The maximum possible mark on this paper was 108 marks. How many marks were available overall?

A 420 B 480 C 540 D 560 E 600

17. The lengths, in cm, of the sides of the equilateral triangle PQR are as shown.



Which of the following could *not* be the values of x and y ?

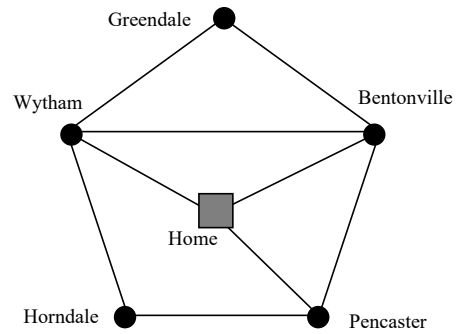
A (18, 12) B (15, 10) C (12, 8) D (10, 6) E (3, 2)

18. Sam's 101st birthday is tomorrow. So Sam's age in years changes from a square number (100) to a prime number (101). How many times has this happened before in Sam's lifetime?

A 1 B 2 C 3 D 4 E 5

19. Pat needs to travel down every one of the roads shown at least once, starting and finishing at home. What is the smallest number of the five villages that Pat will have to visit more than once?

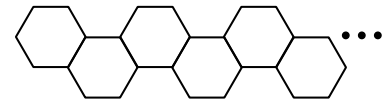
A 1 B 2 C 3 D 4 E 5



20. Nicky has to choose 7 different positive whole numbers whose mean is 7. What is the largest possible such number she could choose?

A 7 B 28 C 34 D 43 E 49

21. A shape consisting of a number of regular hexagons is made by continuing to the right the pattern shown in the diagram, with each extra hexagon sharing one side with the preceding one. Each hexagon has a side length of 1 cm. How many hexagons are required for the perimeter of the whole shape to have length 2010 cm?

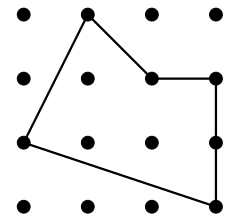


A 335 B 402 C 502 D 670 E 1005

22. Kiran writes down six different prime numbers, p, q, r, s, t, u , all less than 20, such that $p + q = r + s = t + u$. What is the value of $p + q$?

A 16 B 18 C 20 D 22 E 24

23. A single polygon is made by joining dots in the 4×4 grid with straight lines, which meet only at dots at their end points. No dot is at more than one corner. The diagram shows a five-sided polygon formed in this way. What is the greatest possible number of sides of a polygon formed by joining the dots using these same rules?



A 12 B 13 C 14 D 15 E 16

24. The year 2010 belongs to a special sequence of twenty-five consecutive years: each number from 1988 to 2012 contains a repeated digit. Each of the following belongs to a sequence of consecutive years, where each number in the sequence contains at least one repeated digit.

Which of them belongs to the next such sequence of at least twenty years?

A 2099 B 2120 C 2199 D 2989 E 3299

25. What is the value of $P + Q + R$ in the multiplication on the right?

A 13 B 12 C 11 D 10 E 9

$$\begin{array}{r}
 P \quad Q \quad P \quad Q \\
 \times \quad R \quad R \quad R \\
 \hline
 6 \quad 3 \quad 9 \quad 0 \quad 2 \quad 7 \\
 \hline
 \end{array}$$