UK JUNIOR MATHEMATICAL CHALLENGE

THURSDAY 26th APRIL 2018

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

Institute
and Faculty
of Actuaries

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 non-propelling 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.

1. What is the value of (222 + 22) ÷ 2?

   A 111   B 112   C 122   D 133   E 233

2. A train carriage has 80 seats. On my journey I noticed that all the seats in my carriage were taken and 7 people were standing.

   At Banbury, 9 people left the carriage, 28 people entered it and all seats were taken.

   How many people now had no seat?

   A 0   B 7   C 16   D 26   E 35

3. The diagram shows an equilateral triangle, a square, and one diagonal of the square.
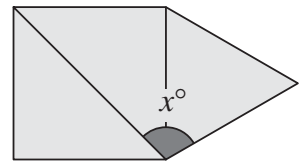
   What is the value of *x*?

   A 105   B 110   C 115   D 120   E 135

4. The perimeter of the regular decagon *P* is 8 times the perimeter of the regular octagon *Q*.

   Each edge of the regular octagon *Q* is 10 cm long.

   How long is each edge of the regular decagon *P*?

   A 8 cm   B 10 cm   C 40 cm   D 60 cm   E 64 cm

5. My train left Southampton at 06:15 and arrived in Birmingham at 08:48 later that morning.

   How many minutes did the journey take?

   A 153   B 193   C 233   D 1463   E 1501

6. The diagram shows a partially completed magic square, in which all rows, all columns and both main diagonals have the same total.

   What is the value of $x + y$?

   A 10   B 11   C 12   D 13   E 14

7. How many integers are greater than $20 + 18$ and also less than 20×18?

   A 320   B 321   C 322   D 323   E 324

8. Gill scored a goal half way through the second quarter of a 'teachers versus pupils' netball match. At that point, what fraction of the whole match remained to be played?

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

9. The approximate cost of restoring the Flying Scotsman was £4 million. This was about 500 times the cost of building the steam engine in 1923.

   Roughly what did the engine cost to build?

   A £800   B £2000   C £8000   D £20 000   E £80 000

10. Adding four of the five fractions $\dfrac{1}{2}, \dfrac{1}{3}, \dfrac{1}{6}, \dfrac{1}{9}$ and $\dfrac{1}{18}$ gives a total of 1.

    Which of the fractions is not used?

    A $\dfrac{1}{2}$ B $\dfrac{1}{3}$ C $\dfrac{1}{6}$ D $\dfrac{1}{9}$ E $\dfrac{1}{18}$

11. How many digits are there in the correct answer to the calculation 123 123 123 123 ÷ 123?

    A 4   B 6   C 8   D 10   E 12

12. The diagram shows a quadrilateral *PQRS* in which *PQ* and
    QR have the same length. Also *PR* bisects ∠*SPQ*, the ratio
    of ∠*SPR* to ∠*PRS* is 2 : 3 and ∠*PSR* = 110°.
    How large is angle *PQR*?
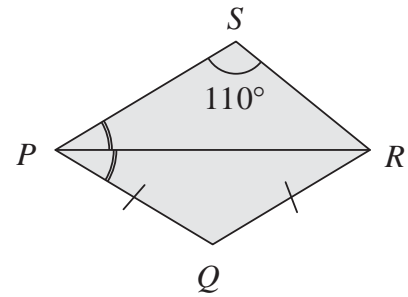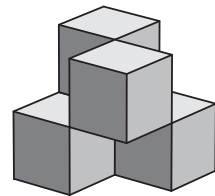
    A 124° B 120° C 110° D 90°   E 28°

13. The diagram shows a shape made from four 3 cm × 3 cm × 3 cm
    wooden cubes joined by their edges.
    What, in cm², is the surface area of the shape?

    A 162   B 180   C 198   D 216   E 234

14. Billy has three times as many llamas as lambs.
    Milly has twice as many lambs as llamas.
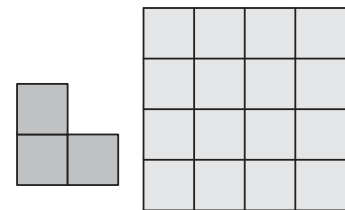   They have 17 animals in total.
    How many of the animals are llamas?

    A 5   B 6   C 7   D 8   E 9

15. Beatrix places copies of the L-shape shown on a 4 × 4 board so
    that each L-shape covers exactly three cells of the board. She is
    allowed to turn around or turn over an L-shape.

    What is the largest number of L-shapes she can place on the
    board without overlaps?
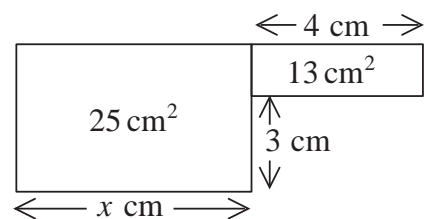
    A 2   B 3   C 4   D 5   E 6

16. How many pairs of digits (*p*, *q*) are there so that the five-digit integer '*p*869*q*' is a multiple of
    15?

    A 2   B 3   C 4   D 5   E 6

17. The areas of the two rectangles in the diagram are 25 cm²
    and 13 cm² as indicated.
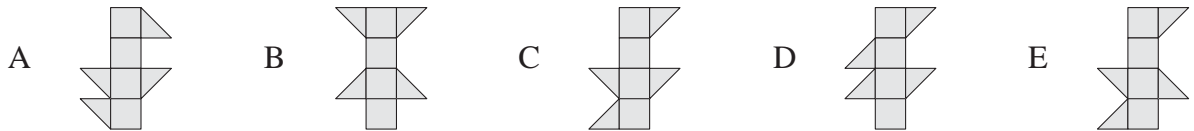   What is the value of *x*?

    A 3   B 4   C 5   D 6   E 7

18. Between them, the two five-digit integers *M* and *N* contain all ten digits from 0 to 9.
    What is the least possible difference between *M* and *N*?

    A 123   B 247   C 427   D 472   E 742

19. Which one of these could be folded to make a cube?

A   B   C   D   E

20. A drawer contains ten identical yellow socks, eight identical blue socks and four identical pink socks.

    Amrita picks socks from the drawer without looking.

    What is the smallest number of socks she must pick to be sure that she has at least two pairs of matching socks?

    A 5　　　　　　B 6　　　　　　C 8　　　　　　D 11　　　　　　E 13

21.
There are ——— vowels in this short sentence.

Which of the following options should replace "———" to make the sentence in the box true?

A twelve　　　B thirteen　　　C fourteen　　　D fifteen　　　E sixteen

22. In the triangles PQR and STU, $\angle RPQ = 2 \times \angle UST$, $\angle PRQ = 2 \times \angle SUT$ and $\angle RQP = \dfrac{1}{5} \times \angle UTS$.

    How large is $\angle UTS$?

    A 90°　　　B 100°　　　C 120°　　　D 150°　　　E more information needed
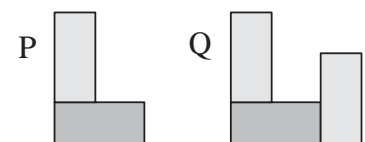
23. Ali wants to fill the empty squares so that the number in each square after the fourth from the left is the sum of the numbers in the four squares to its left.

2		0		1		8	

    What number should Ali write in the final square?

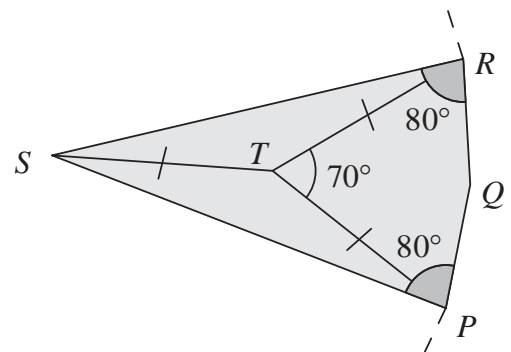   A 16　　　　　　B 8　　　　　　C 4　　　　　　D 2　　　　　　E 1

24. The shapes P and Q are formed from two and three identical rectangles, respectively. Their perimeters are 58 cm and 85 cm respectively.

    What is the perimeter of one of the rectangles?

    A 30 cm　　　　B 31 cm　　　　C 32 cm　　　　D 33 cm　　　　E 34 cm

25. In the diagram PQ and QR are sides of a regular n-sided polygon, $\angle SPQ = \angle SRQ = 80°$, $\angle PTR = 70°$ and $PT = ST = RT$.

    What is the value of n?

    A 15　　B 18　　C 20　　D 24　　E 30