

## UK JUNIOR MATHEMATICAL CHALLENGE

THURSDAY 27th APRIL 2017

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.

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

1. Which of the following calculations gives the largest answer?

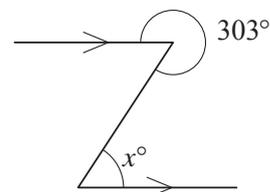
- A  $2 - 1$       B  $2 \div 1$       C  $2 \times 1$       D  $1 \times 2$       E  $2 + 1$

2. Nadiya is baking a cake. The recipe says that her cake should be baked in the oven for 1 hour and 35 minutes. She puts the cake in the oven at 11:40 am. At what time should she take the cake out of the oven?

- A 12:15 pm      B 12:40 pm      C 1:05 pm      D 1:15 pm      E 2:15 pm

3. What is the value of  $x$  ?

- A 43      B 47      C 53      D 57      E 67



4. A download is 95% complete. What fraction is yet to be downloaded?

- A  $\frac{1}{2}$       B  $\frac{1}{5}$       C  $\frac{1}{9}$       D  $\frac{1}{10}$       E  $\frac{1}{20}$

5. What is the value of  $201 \times 7 - 7 \times 102$  ?

- A 142 800      B 793      C 693      D 607      E 0

6. In a magic square, the numbers in each row, each column and the two main diagonals have the same total. This magic square uses the integers 2 to 10. Which of the following are the missing cells?

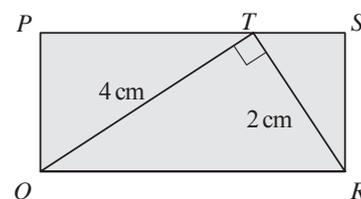
	10	5
8		4
7	2	

- A      B      C      D      E

7. If you work out the values of the following expressions and then place them in increasing numerical order, which comes in the middle?

- A  $\frac{2}{3} + \frac{4}{5}$       B  $\frac{2}{3} \times \frac{4}{5}$       C  $\frac{3}{2} + \frac{5}{4}$       D  $\frac{2}{3} \div \frac{4}{5}$       E  $\frac{3}{2} \times \frac{5}{4}$

8. The diagram shows a rectangle  $PQRS$  and  $T$  is a point on  $PS$  such that  $QT$  is perpendicular to  $RT$ . The length of  $QT$  is 4 cm. The length of  $RT$  is 2 cm.



What is the area of the rectangle  $PQRS$ ?

- A  $6 \text{ cm}^2$       B  $8 \text{ cm}^2$       C  $10 \text{ cm}^2$       D  $12 \text{ cm}^2$       E  $16 \text{ cm}^2$

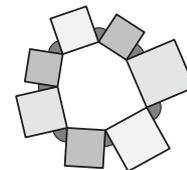
9. In William Shakespeare's play *As You Like It*, Rosalind speaks to Orlando about "He that will divide a minute into a thousand parts".

Which of the following is equal to the number of seconds in one thousandth of one minute?

- A 0.24      B 0.6      C 0.024      D 0.06      E 0.006

10. Which of the following integers is not a multiple of 45?  
 A 765                  B 675                  C 585                  D 495                  E 305

11. Seven squares are drawn on the sides of a heptagon so that they are outside the heptagon, as shown in the diagram.  
 What is the sum of the seven marked angles?  
 A  $315^\circ$           B  $360^\circ$           C  $420^\circ$           D  $450^\circ$           E  $630^\circ$

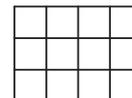


12. Last year, at the school where Gill teaches Mathematics, 315 out of the 600 pupils were girls. This year, the number of pupils in the school has increased to 640. The proportion of girls is the same as it was last year.  
 How many girls are there at the school this year?  
 A 339                  B 338                  C 337                  D 336                  E 335

13. Consider the following three statements.  
 (i) Doubling a positive number always makes it larger.  
 (ii) Squaring a positive number always makes it larger.  
 (iii) Taking the positive square root of a positive number always makes it smaller.  
 Which statements are true?

- A All three          B None                  C Only (i)              D (i) and (ii)          E (ii) and (iii)

14. Mathias is given a grid of twelve small squares. He is asked to shade grey exactly four of the small squares so that his grid has two lines of reflection symmetry.  
 How many different grids could he produce?



- A 2                  B 3                  C 4                  D 5                  E 6

15. What is the remainder when the square of 49 is divided by the square root of 49?  
 A 0                  B 2                  C 3                  D 4                  E 7

16. In New Threeland there are three types of coins: the 2p; the 5p; and one other. The smallest number of coins needed to make 13p is three. The smallest number of coins needed to make 19p is three. What is the value of the third type of coin?

- A 4p                  B 6p                  C 7p                  D 9p                  E 12p

17. I add up all even numbers between 1 and 101. Then from my total I subtract all odd numbers between 0 and 100.  
 What is the result?

- A 0                  B 50                  C 100                  D 255                  E 2525

18. What is the sum of the digits in the completed crossnumber?

ACROSS 1. A cube 3. A power of 11	DOWN 2. A square	<table border="1" style="display: inline-table; text-align: center;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px; border: 1px solid black;">1</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px; border: 1px solid black;">2</td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td style="width: 20px; height: 20px; border: 1px solid black;">3</td> <td style="width: 20px; height: 20px;"></td> </tr> </table>		1		2		3				
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- A 25                  B 29                  C 32                  D 34                  E 35

