

UK INTERMEDIATE MATHEMATICAL CHALLENGE

THURSDAY 6TH FEBRUARY 2003

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



RULES AND GUIDELINES (to be read before starting)

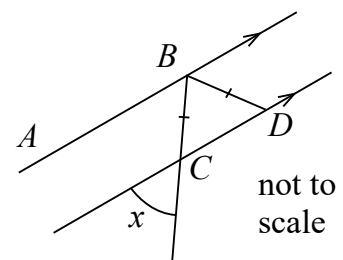
1. Do not open the paper until the Invigilator tells you to do so.
2. Time allowed: **1 hour**.
No answers, or personal details, may be entered after the allowed hour is over.
3. The use of rough paper is allowed; **calculators** and measuring instruments are **forbidden**.
4. Candidates in England and Wales must be in School Year 11 or below.
Candidates in Scotland must be in S4 or below.
Candidates in Northern Ireland must be in School Year 12 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 IMC is about solving interesting problems, not about lucky guessing.

The UKMT is a registered charity

- What is the value of 3 divided by $\frac{1}{2}$?
 A $\frac{1}{6}$ B $\frac{2}{3}$ C $1\frac{1}{2}$ D $4\frac{1}{2}$ E 6
- Four of these tiles may be put side by side so that they simultaneously spell two imperial units of length. Which tile is left out?
 A $\begin{array}{|c|} \hline E \\ \hline D \\ \hline \end{array}$ B $\begin{array}{|c|} \hline I \\ \hline A \\ \hline \end{array}$ C $\begin{array}{|c|} \hline L \\ \hline R \\ \hline \end{array}$ D $\begin{array}{|c|} \hline K \\ \hline C \\ \hline \end{array}$ E $\begin{array}{|c|} \hline M \\ \hline Y \\ \hline \end{array}$
- You are given that $2786 \times 231 = 643566$. What is the value of $643566 \div 27.86$?
 A 23100 B 2310 C 231 D 23.1 E 2.31
- The coach of the Irish hockey team has a maximum speed of 60 miles per hour. If it travels at this speed for two hours, roughly how many kilometres does it travel?
 A 120 B 160 C 200 D 240 E 280
- What is the value of 2003^2 ?
 A 4009 B 400 009 C 401 209 D 4 000 009 E 4 012 009
- Think of a number, double it, then add 3. Multiply your answer by 4 and from this take away 5. Now also take away the number you first thought of. No matter what your first number was, your answer will be a multiple of:
 A 2 B 3 C 5 D 7 E 11
- Last year a newspaper reported that Turkish football team Sarigol Municipality transferred four of its players in return for a fee of 225 sacks of cement, needed to repair their stadium. At the same rate of exchange, how many sacks of cement would be the transfer fee for a full team of eleven players and one reserve?
 A 233 B 450 C 675 D 900 E 2700

- Lines AB and CD are parallel and $BC = BD$. Given that x is an acute angle not equal to 60° , how many *other* angles in this diagram are equal to x ?

- A 1 B 2 C 3 D 4 E 5

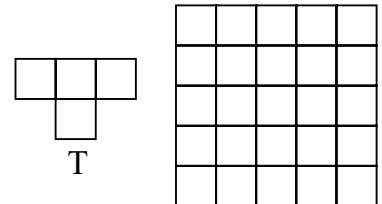


- It has been estimated that the mass of insects caught by spiders in a year in the UK is equal to the mass of the human population of the UK. Assuming this population is 60 million and the average mass of a human is 70 kg, what is the mass, in tonnes, of insects caught by spiders per year in the UK?
 A 4.2 B 42 C 4200 D 420 000 E 4 200 000
- The time shown on a digital clock is 5:55. How many minutes will pass before the clock next shows a time for which all the digits are the same?
 A 71 B 255 C 316 D 377 E 436

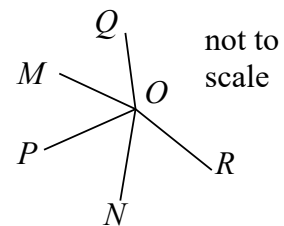
11. Which of the following fractions is in the middle when they are written in numerical order?
 A $\frac{4}{7}$ B $\frac{5}{8}$ C $\frac{3}{4}$ D $\frac{7}{11}$ E $\frac{8}{13}$

12. Each edge of a cube is coloured either red or black. If every face of the cube has at least one black edge, what is the smallest possible number of black edges?
 A 2 B 3 C 4 D 5 E 6

13. What is the maximum number of pieces with the shape T which can be placed within the 5×5 grid shown, without overlapping, and with their edges along the lines of the grid?
 A 3 B 4 C 5 D 6 E 7



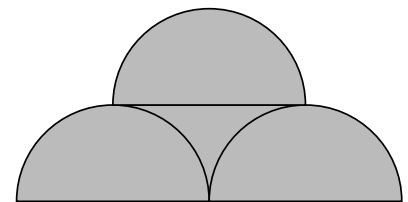
14. In the diagram, $\angle MON = 130^\circ$. The reflection of OP in OM is OQ and the reflection of OP in ON is OR . What is the size of $\angle QOR$?
 A 100° B 120° C 140° D 150° E 160°



15. Each interior angle of a particular polygon is an obtuse angle which is a whole number of degrees. What is the greatest number of sides the polygon could have?
 A 90 B 179 C 180 D 359 E 360

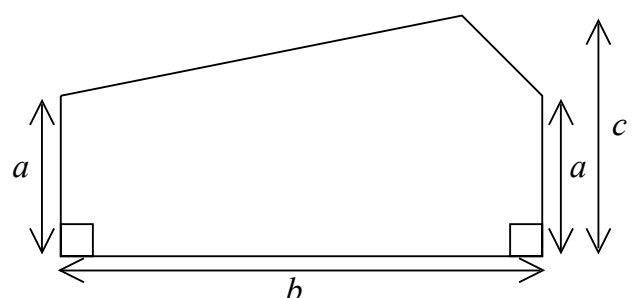
16. After a year's training, Minnie Midriffe increased her average speed in the London Marathon by 25%. By what percentage did her time decrease?
 A 50 B 30 C 20 D 10 E 5

17. The diagram shows three semicircles, each of radius one. What is the size of the total shaded area?
 A $\pi + 2$ B 5 C $\frac{3}{2}\pi + 1$
 D 4 E $2\pi - 1$



18. When dates are written using eight digits, e.g. 06 02 2003 for today, the 20th of February 2002 is a palindromic date since 20 02 2002 has the same digits in the same order when read in reverse. The previous palindromic date and the next few all occur in the month of February. What will be the next month other than February to have a palindromic date in it?
 A March B April C October D November E December

19. What is the area of the pentagon shown?
 A $\frac{1}{2}a(b - c)$ B $\frac{1}{2}b(a + c)$
 C $\frac{1}{2}a(b + c)$ D $\frac{1}{2}b(c - a)$
 E $\frac{1}{2}c(a + b)$

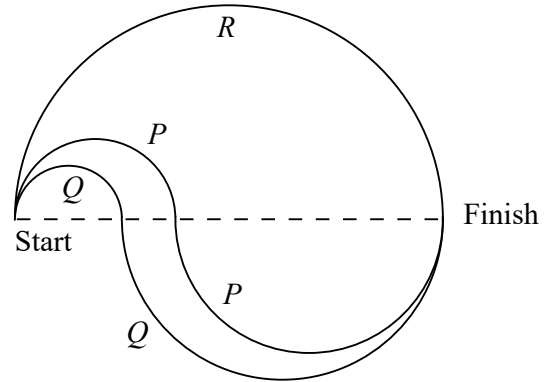


20. Suppose that e, i, n and t represent different positive whole numbers, $n + i + n + e = 9$, $t + e + n = 10$ and $i = 1$. What is t ?

- A 2 B 3 C 4 D 5 E 6

21. In a leisure park there are three running tracks, all with the same Start and Finish, and all made from either one or two semicircles with centres on the same line.

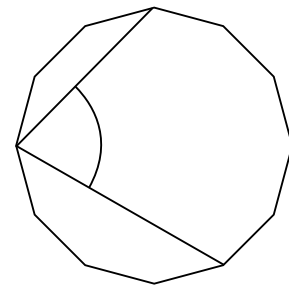
Three runners P, Q and R start together at the Start and run at the same constant speed along the tracks as shown. In what order do they reach the Finish?



- A P then Q then R B R first then P and Q together C R then Q then P
 D all three together E more information needed

22. The diagram shows a regular dodecagon (a polygon with twelve equal sides and equal angles). What is the size of the marked angle?

- A 67.5° B 72° C 75°
 D 82.5° E 85°

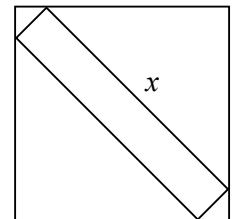


23. Given that it takes a men b hours to paint c square metres of the Forth Bridge, how long would it take d men to paint e square metres of the bridge?

- A $\frac{abe}{cd}$ B $\frac{abd}{ce}$ C $\frac{abc}{de}$ D $\frac{acd}{be}$ E $\frac{ace}{bd}$

24. The diagram shows a $1 \times x$ rectangular plank which fits neatly inside a 10×10 square frame. What is the value of x ?

- A $10 + 2\sqrt{2}$ B $10\sqrt{2} - 1$ C $10\sqrt{2} - 2$
 D $10 + \sqrt{2}$ E 12



25. The width : height ratio of television screens is changing from the traditional 4 : 3 to the widescreen 16 : 9. If a traditional screen and a widescreen have the same area, then what is the ratio widescreen width : traditional width?
 (Assume that television screens are rectangles.)

- A $2 : \sqrt{3}$ B $3 : 2$ C $3 : \sqrt{2}$ D $4 : 3$ E none of these