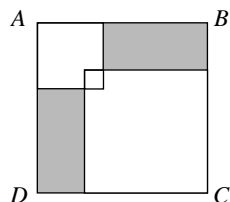


20. Jack's teacher asked him to draw a triangle of area 7cm^2 . Two sides are to be of length 6cm and 8cm. How many possibilities are there for the length of the third side of the triangle?

A 1 B 2 C 3 D 4 E more than 4

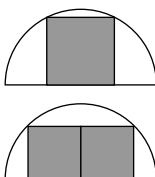
21. The square $ABCD$ has an area of 196. It contains two overlapping squares; the larger of these squares has an area 4 times that of the smaller and the area of their overlap is 1. What is the total area of the shaded regions?

A 44 B 72 C 80 D 152
E more information is needed



22. The diagrams show squares placed inside two identical semicircles. In the lower diagram the two squares are identical. What is the ratio of the areas of the two shaded regions?

A 1 : 2 B 2 : 3 C 3 : 4 D 4 : 5 E 5 : 6



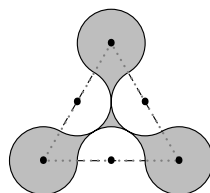
23. Four brothers are discussing the order in which they were born. Two are lying and two are telling the truth. Which two are telling the truth?

Alfred: "Bernard is the youngest." Horatio: "Bernard is the oldest and I am the youngest."
Inigo: "I was born last." Bernard: "I'm neither the youngest nor the oldest."

A Bernard and Inigo B Horatio and Bernard C Alfred and Horatio
D Alfred and Bernard E Inigo and Horatio

24. The diagram shows a shaded shape bounded by circular arcs with the same radius. The centres of three arcs are the vertices of an equilateral triangle; the other three centres are the midpoints of the sides of the triangle. The sides of the triangle have length 2. What is the difference between the area of the shaded shape and the area of the triangle?

A $\frac{\pi}{6}$ B $\frac{\pi}{4}$ C $\frac{\pi}{3}$ D $\frac{\pi}{2}$ E π



25. In 1984 the engineer and prolific prime-finder Harvey Dubner found the biggest known prime each of whose digits is either a one or a zero. The prime can be expressed as $\frac{10^{641} \times (10^{640} - 1)}{9} + 1$. How many digits does this prime have?

A 640 B 641 C 1280 D 1281 E 640×641



UK INTERMEDIATE MATHEMATICAL CHALLENGE

THURSDAY 7TH FEBRUARY 2013

Organised by the **United Kingdom Mathematics Trust**
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RULES AND GUIDELINES (to be read before starting)

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

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