UK Maths Trust

UKMT Mentoring Scheme

How to decide which level of the scheme is suitable for your students

Guidance for teachers

We rely on your judgement to enter a pupil for what seems to be the most appropriate level. You should advise pupils that they will find the questions challenging, and that they should not expect to be able to answer them all without help from their mentor. However, if they find they cannot make progress with around half the questions on the first one or two sheets, they should ask to be moved to a level which is more suitable for them. We can't guarantee to be able to meet such requests, but normally we will be able to do so.

What are the mathematical demands of the different levels?

As a broad guide to the mathematical content requirements of the nine levels:

The lowest levels – Pythagoras, Hypatia and Archimedes generally require a reasonable confidence with Year 7 and some Year 8 topics (England and Wales), Year 8 and 9 (Northern Ireland) and S2 and S3 (Scotland), including Pythagoras' Theorem and some geometry theorems, though many questions on the Pythagoras sheet require only Key Stage 2 mathematics content (or content covered during the Broad General Stage in Scotland).

The middle levels – Cartwright, Robinson and Noether require the Key Stage 3 content and some GCSE content or, for students in Scotland, require fourth level content and some National 5 content.

The highest levels – Neumann, Hardy and Ramanujan assume the whole GCSE or National 5 content. While the first two do not assume any prior knowledge of post-GCSE topics, they do introduce some through the questions themselves, including such topics as triangle centres, the AM-GM inequality and binomial coefficients. The final level, Srinivasa Ramanujan, does include some questions that use A-level or Higher/ Advanced Higher topics such as calculus and complex numbers. These three levels would be best suited to students studying for Highers or Advanced Highers in Scotland.

In addition to this, the questions typically require mathematical maturity to engage in extended reasoning (without being told what to do) and to communicate their answers in writing. This generally makes them more challenging than typical textbook or exam questions on the same content.

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What is a suitable level for my student/s?

A suitable level is generally one in which they can answer, with effort, about half to two-thirds of the questions on the first few sheets. The levels are intended to be progressively more difficult, so it may be wise to start on an earlier level and then move to a later level if it is found to be too easy. Within each level, there are also some questions which refer back to earlier question sheets, so it is wise to begin with sheet 1 if possible.

The Mentoring Scheme is intended to help stretch students and teach them to work on particular types of problems. The questions are deliberately hard, but it can be quite demoralising for a student if they are unable to answer more than two or three on a sheet. It is also the case that newly learnt material may not yet be fluent enough in your students' minds to be able to use it in a problem-solving context.

You may find that the Pythagoras sheets are a suitable starting point for many good Year 10 (S3 Scotland, Year 11 NI) students, as without previous sustained experience of this type of problem solving, they would be likely to struggle on the Mary Cartwright level.

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How do the mentoring sheet levels relate to the UKMT Challenges?

Another indication of a suitable level for a student is their past performance on the UKMT (individual) Maths Competitions. As a rough indication, if a student has achieved any of the following, consider starting on the suggested programme (click the programme names for sample sheets):

- Silver or above in the JMC - **Pythagoras**
- Participation in the Junior Kangaroo - **Pythagoras** **or** **Hypatia**
- A score of 20 or more in the JMO - **Hypatia** **or** **Archimedes**
- Silver or above in the IMC - **Archimedes** **or** **Cartwright**
- A certificate of Merit in the Grey or Pink Kangaroo - **Archimedes**, **Cartwright** **or** **Robinson**
- A score of 20 or more in Cayley, Hamilton and/or Maclaurin Mathematical Olympiads - **Cartwright**, **Robinson** **or** **Noether**
- Silver or above in the SMC - **Cartwright**, **Robinson** **or** **Noether**
- A certificate of Merit in the Andrew Jobbings Senior Kangaroo - **Noether** **or** **Neumann**
- A score of 20 or more in BMO1 - **Neumann**

Students should complete most of the Hanna Neumann level before tackling the G.H. Hardy level, and they should complete the majority of the G.H. Hardy level before beginning the Srinivasa Ramanujan level. We expect that very few students nationally will reach the G.H. Hardy level.

Students should not begin the scheme at Hardy or Ramanujan.

It is important to remember that while the Maths Challenges and Kangaroos consist of short multiple-choice papers, the Mentoring Scheme questions are longer and require full written solutions; this makes them more demanding while still addressing the same content.

It is much better to start with an earlier level and then to progress to a later level if the earlier one is too easy than the other way round!

If you need further help deciding on the appropriate level for your student, or have any other questions, please contact us at mentoring@ukmt.org.uk