Summary of recommendations

Improving mathematics in upper primary and lower secondary

1. **Use assessment to build on students’ existing knowledge and understanding**
   - Assessment should be used not only to track students’ learning but also to provide teachers with information about what students do and do not know.
   - This should inform the planning of future lessons and the focus of targeted support.
   - Effective feedback will be an important element of teachers’ response to assessment.
   - Feedback should be specific and clear, encouraging and support further effort, and be given promptly.
   - Teachers not only have to address misconceptions but also understand why students may persist with errors.
   - Knowledge of common misconceptions can be invaluable in planning lessons to address errors before they arise.

2. **Use manipulatives and representations**
   - Manipulatives (physical objects used to teach maths) and representations (such as number lines and graphs) can help students engage with mathematical ideas.
   - However, manipulatives and representations are just tools; how they are used is essential.
   - They need to be used purposefully and appropriately to have an impact.
   - There must be a clear rationale for using a particular manipulative or representation to teach a specific mathematical concept.
   - Manipulatives should be temporary; they should act as a ‘scaffold’ that can be removed once independence is achieved.

3. **Teach strategies for solving problems**
   - If students lack a well-rehearsed and readily available method to solve a problem, they need to draw on problem-solving strategies to make sense of the unfamiliar situation.
   - Select problem-solving tasks for which students do not have ready-made solutions.
   - Teach students to use and compare different approaches.
   - Show students how to interrogate and use their existing knowledge to solve problems.
   - Use worked examples to enable students to analyse the use of different strategies.
   - Require students to monitor, reflect on, and communicate their problem-solving strategies.

4. **Enable students to develop a rich network of mathematical knowledge**
   - Emphasise the many connections between mathematical facts, procedures, and concepts.
   - Ensure that students develop fluent recall of facts.
   - Teach students to understand procedures.
   - Teach students to consciously choose between mathematical strategies.
   - Build on students’ informal understanding of sharing and proportionality to introduce procedures.
   - Teach students that fractions and decimals extend the number system beyond whole numbers.
   - Teach students to recognise and use mathematical structure.

5. **Develop students’ independence and motivation**
   - Encourage students to take responsibility for, and play an active role in, their own learning.
   - This requires students to develop metacognition – the ability to independently plan, monitor and evaluate their thinking and learning.
   - Initially, teachers may have to model metacognition by describing their own thinking.
   - Provide regular opportunities for students to develop metacognition by encouraging them to explain their thinking to themselves and others.
   - Avoid doing too much too early.
   - Positive attitudes are important, but there is scant evidence on the most effective ways to foster them.
   - School leaders should ensure that all staff, including non-teaching staff, encourage enjoyment in maths for all children.

6. **Use tasks and resources to challenge and support students’ mathematics**
   - Tasks and resources are just tools – they will not be effective if they are used inappropriately by the teacher.
   - Use assessment of students’ strengths and weaknesses to inform your choice of task.
   - Use tasks to address student misconceptions.
   - Provide examples and non-examples of concepts.
   - Use stories and problems to help students understand mathematics.
   - Use tasks to build conceptual knowledge in tandem with procedural knowledge.
   - Technology is not a silver bullet – it has to be used judiciously and less costly resources may be just as effective.

7. **Use structured interventions to provide additional support**
   - Selection should be guided by student assessment.
   - Interventions should start early, be evidence-based and be carefully planned.
   - Interventions should include explicit and systematic instruction.
   - Even the best-designed intervention will not work if implementation is poor.
   - Support students to understand how interventions are connected to whole-class instruction.
   - Interventions should motivate students – not bore them or cause them to be anxious.
   - If interventions cause students to miss activities they enjoy, or content they need to learn, teachers should ask if the interventions are really necessary.
   - Avoid “intervention fatigue”. Interventions do not always need to be time-consuming or intensive to be effective.

8. **Support students to make a successful transition between primary and secondary school**
   - There is a large dip in mathematical attainment and attitudes towards maths as children move from primary to secondary school.
   - Primary and secondary schools should develop shared understandings of curriculum, teaching and learning.
   - When students arrive in Year 7, quickly attain a good understanding of their strengths and weaknesses.
   - Structured intervention support may be required for Year 7 students who are struggling to make progress.
   - Carefully consider how students are allocated to maths classes.
   - Setting is likely to lead to a widening of the attainment gap between disadvantaged students and their peers, because the former are more likely to be assigned to lower groups.