

Characteristics of questions to assess problem solving

Varying the presentation

- Questions set within unfamiliar contexts or formats
- Questions based on authentic scenarios.
- Questions which are open-ended
- Questions requiring the translation of text into mathematical forms

Making choices

- Questions in which a method of approach is not immediately obvious
- Questions which can be solved by a range of methods
- Questions requiring the selection of relevant information
- Questions with multiple steps but little or no scaffolding

Thinking mathematically

- Questions requiring abstract thinking
- Questions requiring assumptions to be made
- Questions requiring movement between mathematical representations e.g. numerical, graphical, diagrammatic, algebraic
- Questions requiring the synthesis of mathematical ideas or approaches

Obtaining results

- Questions leading to a range of different possible solutions
- Questions involving the interpretation of solutions
- Questions requiring the communication of solutions

Making modifications

- Questions enabling the critical analysis of solutions
- Questions requiring the evaluation of solutions
- Questions in which information can be revised
- Questions in which approaches can be refined

Notes on terminology

Authentic tasks are based on situations which, while sometimes fictional, represent the kinds of problem encountered in real life.

In mathematics a question with scaffolding is one which contains intermediate prompts that provide guidance on the steps to be taken. Sometimes this is achieved by dividing a question into multiple parts which provide direction on the steps to be followed.

The word 'solution' is used to encompass the wide range of possible outcomes from a problem solving question e.g. mathematical results or findings.

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Key messages from *Problem solving in mathematics: realising the vision through better assessment*



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Key messages from *Problem solving in mathematics: realising the vision through better assessment*

If all young people are to successfully progress into university or employment well prepared for the mathematical and quantitative demands of the modern world, there is a clear need for improvements in the teaching, learning and assessment of problem solving across all phases.

Principles

- Problem solving is an important component of mathematics across all phases of education.
- Mathematics assessment should reflect what the mathematics community, employers and universities value about the subject.
- At their best, summative assessments in mathematics should provide learners with rich and diverse opportunities for problem solving.
- Problem solving must remain a key policy priority for mathematics assessment.

Problem solving is something that all learners should experience. A challenging problem solving question at a particular phase of learning does not necessarily require difficult mathematics.

The assessment of problem solving

The table sets out a list of desirable characteristics of questions used to assess problem solving. The list is not exhaustive, but aims to capture key recurring themes that arise repeatedly in discussions on the effective assessment of problem solving. Questions designed to assess problem solving within tests and examinations should be expected to contain some, but not necessarily all, of these characteristics.

What do the characteristics of questions set out in the table mean in terms of assessment and test design?

- At all stages of mathematics education the avoidance of predictability in questions within assessments is key.
- Choosing appropriate methods of approach is an important part of the problem solving approach.
- Mathematical solutions may have to be interpreted and communicated to provide answers to specific questions.
- Problem solving questions can sometimes test mathematical thinking by probing closely-related variants of the original question.

What do the characteristics of questions mean in terms of mark schemes?

- Mark schemes that reward problem solving processes will serve to encourage the embedding of problem solving.
- More open-ended questions will require mark schemes that are less prescriptive than those suitable for questions involving more routine tasks.

