

The MA annual conference: Inspiring Teachers

Reasoning about the problems of
inspirational teaching

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Aims



To:

- reflect on what makes an inspiring teacher
- explore characteristics that might underpin inspirational teaching.

Inspiring Teachers



1. Inspiring teachers = teachers who inspire
or
2. Inspiring teachers = teachers being inspired (by someone/something)

Pause for thought ...

Who gave you mathematical inspiration,
and when?

What was it that she/he/they did that
inspired you?

Discuss!



Mathematical inspiration: who, and when

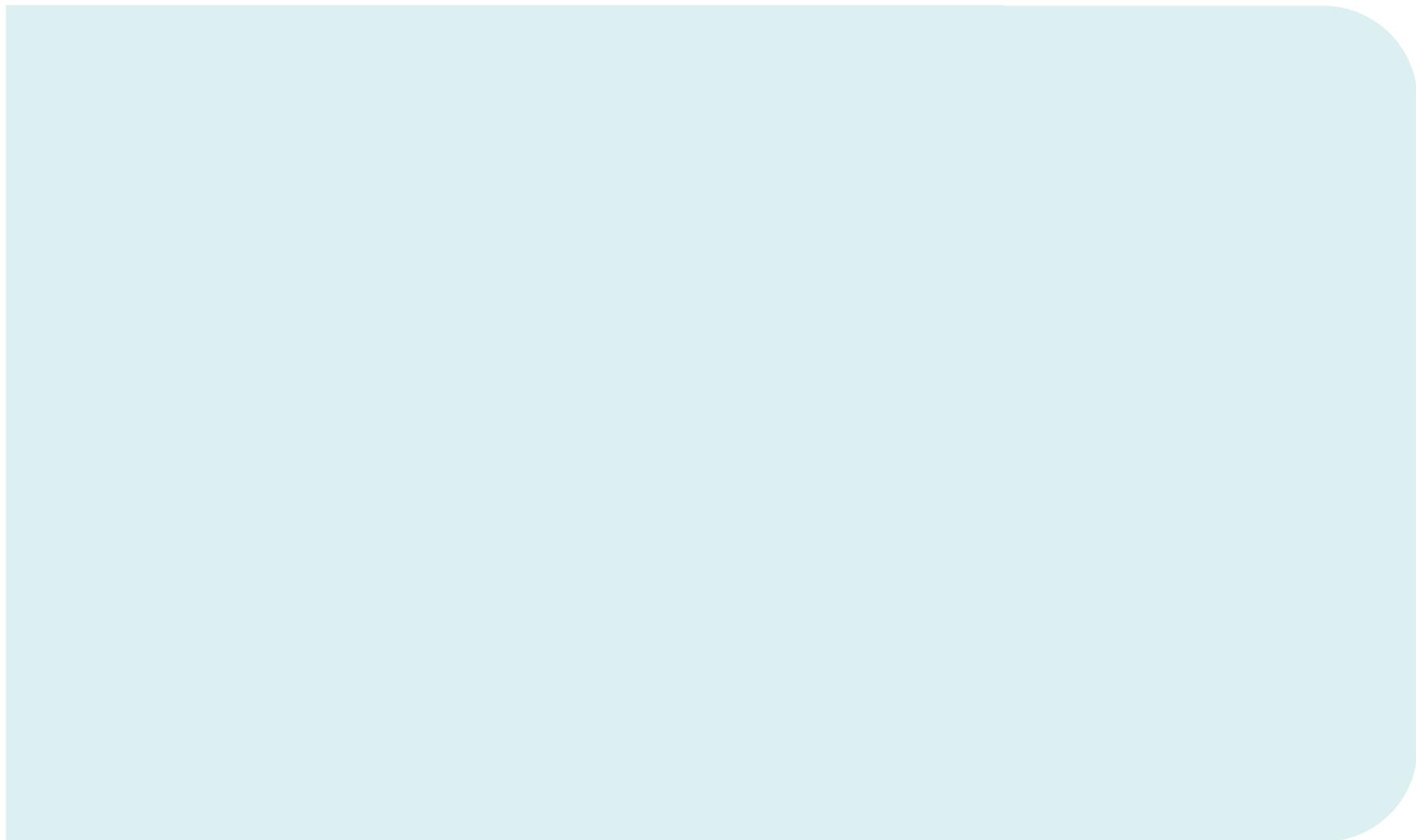
- Who?
 - a teacher/tutor
 - a parent/sibling/other relative
 - another adult
 - a pupil
- When?
 - at primary/secondary school
 - outside of primary/secondary school
 - when studying post-18 and/or training to be a teacher
 - during CPD activities.

Mathematical inspiration: how

What was it that she/he/they did that inspired you?

- believed in you
- challenged you
- excited you about some mathematics
- excited you through how she/he/they taught or talked about some mathematics
- helped you believe in yourself and mathematics
- ...

Characteristics of inspirational teaching



'Inspirational' is not a new Ofsted grade for teaching!

It might happen in magical moments or build like a slow-burning fire.

The idea of 'typicality over time' probably wouldn't describe it.



Inspirational teaching



- Inspirational teaching might include some/all of the following:
 - a belief that all can achieve
 - enthusiasm that reflects an infectious love of mathematics
 - insight into pupils' thinking and the expertise to know how to develop, deepen and/or capitalise on it
 - a readiness to explore pupils' ideas – fruitfully, knowing how the mathematics curriculum fits together
 - ...
- It is enabling – developing self-belief, enjoyment and a will to rise to challenges and grapple with mathematics.

Teaching that enables



- Teaching that enables is likely to promote, across the mathematics curriculum, (and beyond?):
 - reasoning
 - problem solving
 - fluency (knowledge, proficiency with skills, and secure conceptual understanding).

for all pupils.

Teachers inspiring teachers

- At this conference, for instance!
- Teachers (and teaching assistants, and senior leaders) who work on mathematical activities together can help each other deepen and broaden their subject expertise.
- And teachers inspiring parents?

The importance of subject expertise



Subject knowledge and pedagogic skills underpin the development of:

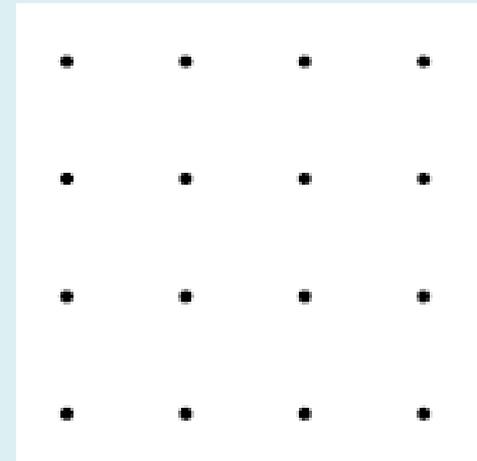
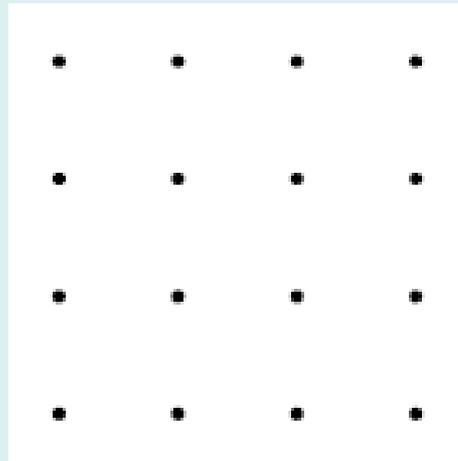
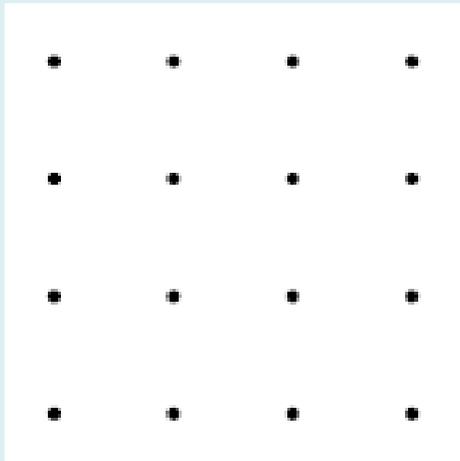
- conceptual understanding, knowledge and skills to build fluency
- problem solving and reasoning
- progression and links.

Subject knowledge and pedagogic skills are necessary for:

- anticipating, spotting and overcoming misconceptions
- observing, listening, questioning to assess learning and adapt teaching.

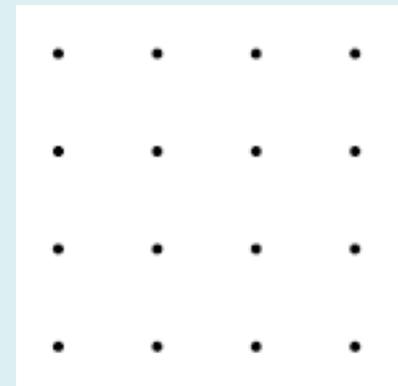
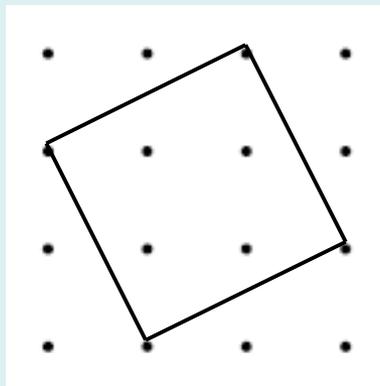
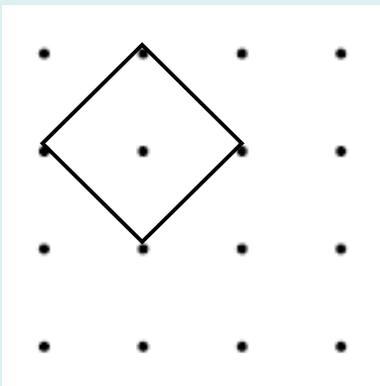
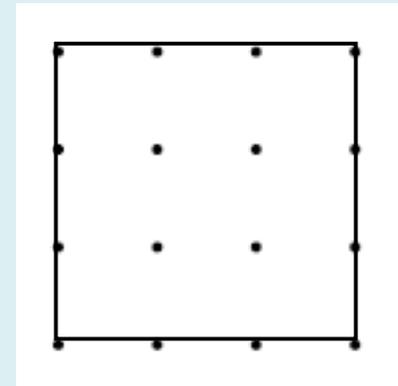
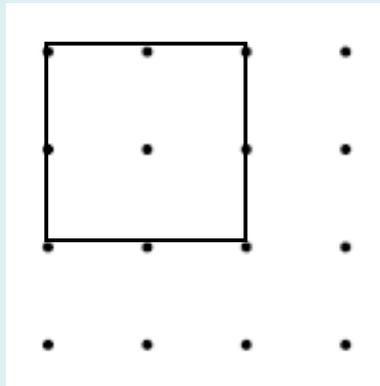
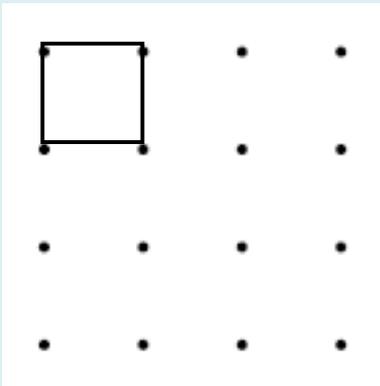
Squares activity

- How many squares of different sizes can you draw on the dotted paper, (with vertices placed on the dots)?
- How do you know for certain that each shape is a square?



Squares activity

Five different-sized squares can be drawn:



Survey findings on mathematics CPD



- Wide variability in the CPD provided for primary staff.
- The best reflected a grasp of the challenges, including:
 - development of the National Curriculum aims, especially reasoning and problem-solving
 - ensuring pupils understand calculation strategies and make connections between different methods and operations
 - how to challenge and deepen learning for the more able, aka the 'rapid graspers'
 - strengthening teachers' subject knowledge.
- The weakest: limited attention given to the mathematics NC.

Developing reasoning: primes & factors



Find the number, given the following clues:

- | | |
|--|--|
| <ul style="list-style-type: none">■ it's less than 100■ it's one more than a multiple of 3■ exactly one of its digits is a prime■ if you reverse the digits, you get a prime■ it's not a multiple of 5 | <ul style="list-style-type: none">■ it's not prime■ it has exactly 4 factors■ it's not square■ the sum of its digits is prime■ if you multiply it by 5, the answer is greater than 100 |
|--|--|

- Which clues were the most useful, which the least? Why?

Reasoning

Reasoning is integral to the development of conceptual understanding and problem-solving skills.

2014/15 survey findings:

- Of the three NC aims, it is the least well developed.
- Not all classrooms have a positive ethos that encourages learning from mistakes.
- Teachers do not exploit opportunities to model thinking.
- Tasks are not used well enough to develop reasoning.
- Talk often focuses on the 'how' rather than the 'why', 'why not', and 'what if' in:
 - teachers' explanations and questions
 - pupils' responses.

With a partner, discuss this question, the pupil's answer, and the teacher's comment.

8. Reasonableness Marty ate $\frac{4}{6}$ of his pizza and Luis ate $\frac{5}{6}$ of his pizza. Marty ate more pizza than Luis. How is that possible?



Marty's pizza is bigger
than Luis's pizza.

That is not possible
because $\frac{5}{6}$ is greater
than $\frac{4}{6}$ so Luis ate
more

Marty's pizza is bigger than Luis's pizza.

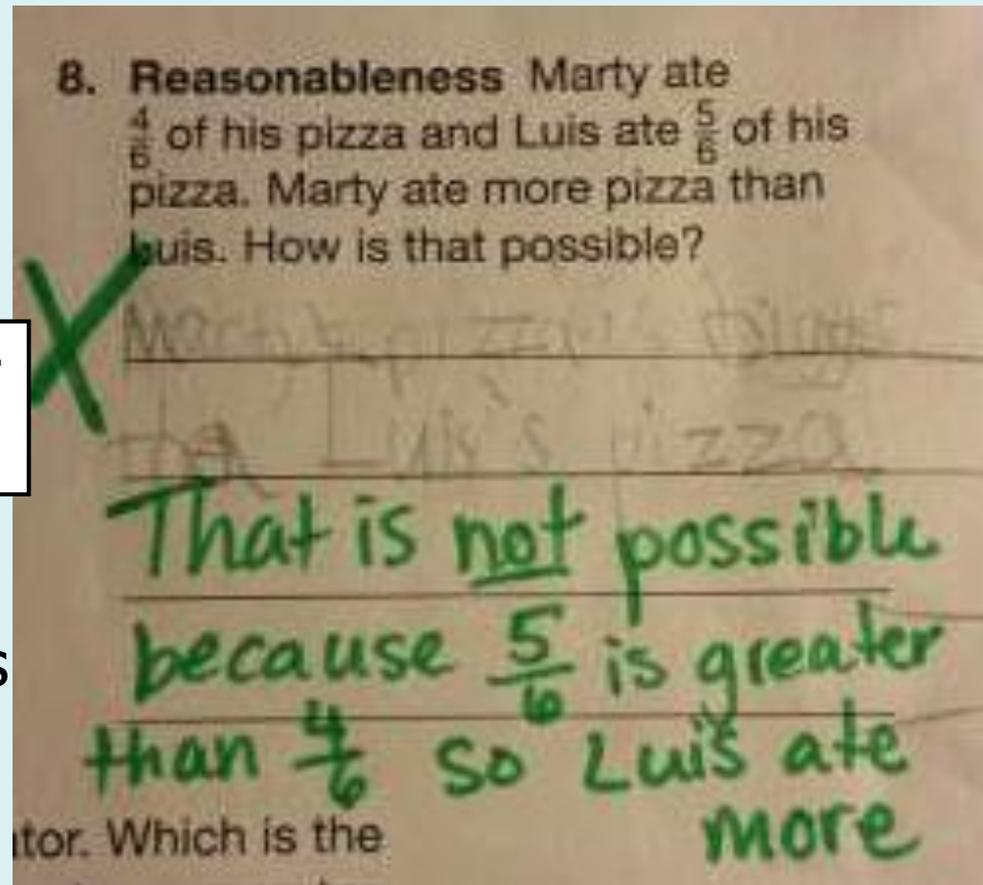


Opportunities for developing reasoning

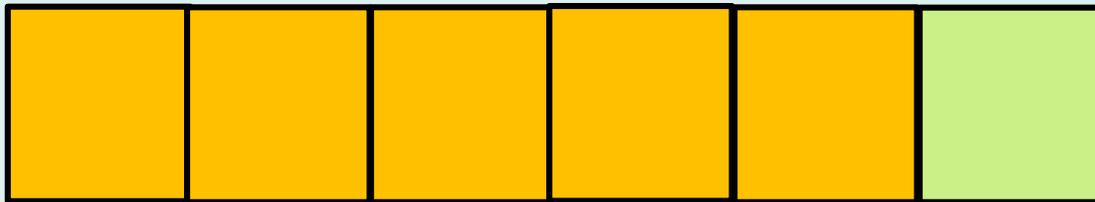
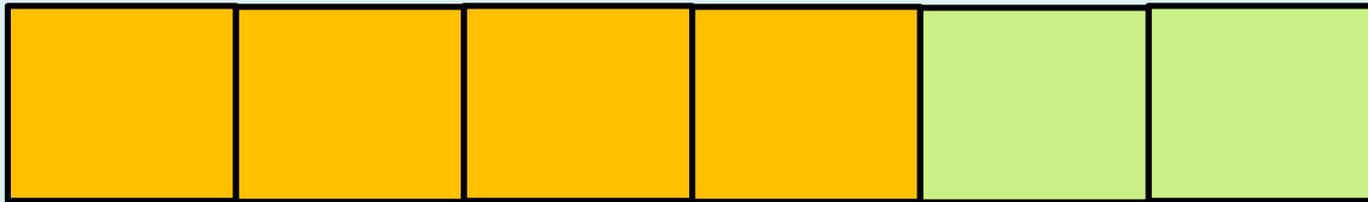
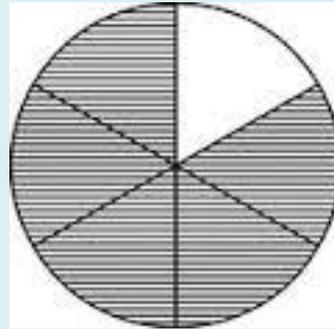
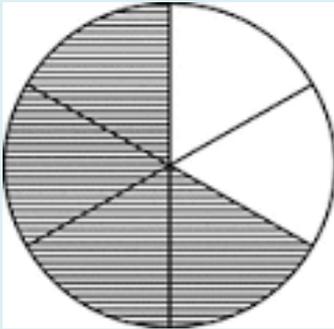
- Under what mathematical circumstances is the:
 - teacher correct?
 - pupil correct?

Marty's pizza is bigger than Luis's pizza.

- How much bigger than Luis's pizza would Marty's pizza have to be for the pupil's answer to be completely correct?



Reasoning with images



Problems and puzzles



- Problems do not have to be set in real-life contexts. Beware pseudo contexts.
- Providing a range of puzzles and other problems helps pupils to reason strategically to:
 - find possible ways into solving a problem
 - sequence an unfolding solution to a problem
 - use recording to help their thinking about the next step.
- It is particularly important that teachers and teaching assistants stress such reasoning, rather than just checking whether the final answer is correct.
- All pupils need to learn how to solve problems – not just the high attainers or fastest workers.

A problem for you to solve

The animals represent values.

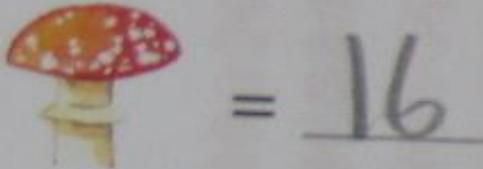
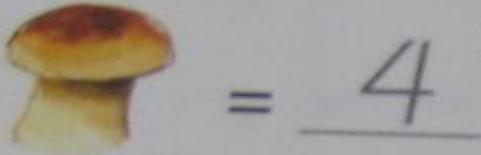
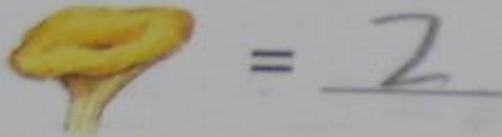
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Which value could be found first, next and last, and why?

Which value cannot be found second and why?

A problem from a Finnish textbook

8. Ratkaise, mitä lukuja kuvat tarkoittava



Teaching problem solving ... do:



- set problems as part of learning in all topics for all pupils
- vary the ways in which you pose problems
- try to resist prompting pupils too soon and focusing on getting 'the answer' – pupils need to build their confidence, skills and resilience in solving problems, so that they can apply them naturally in other situations
- make sure you discuss with pupils alternative approaches to help develop their reasoning. If relevant, consider why one approach/solution might be more elegant than another
- ensure that problems for high attainers/'rapid graspers' involve more demanding reasoning and problem-solving skills and not just harder numbers.

Pause for thought ...

... reflect on your day-to-day practice:
what barriers can you overcome to create
more space for thinking about your
teaching? (or walking the dog or talking to
your partner/children)?

Discuss!



Good practice in teachers' marking



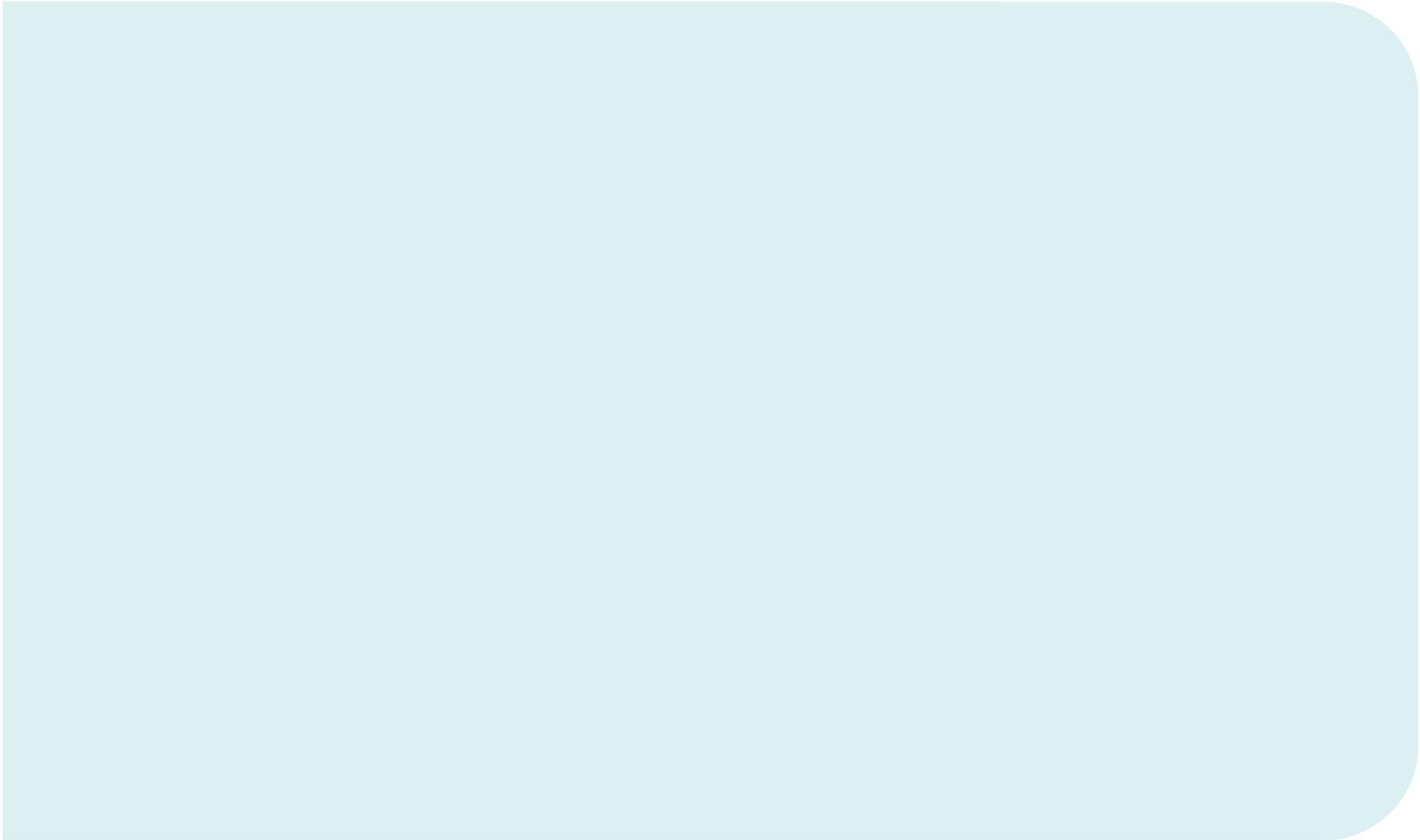
- Is manageable as well as useful. Careful selection of work set in lessons and for homework can support teachers' better assessment of what pupils understand and can do.
- Concentrates on important mathematical aspects, such as misconceptions and recurring errors. Prompts/comments help pupils to see where they have gone wrong, point the way forward, enable pupils to think again and self-correct.
- Includes use of 'what if ...?' and/or 'try this ...' as ways to challenge pupils and/or check they understand.
- Might contribute to whole-school literacy through emphasis on mathematical reasoning, correct mathematical presentation and accurate use of mathematical language/symbols.

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