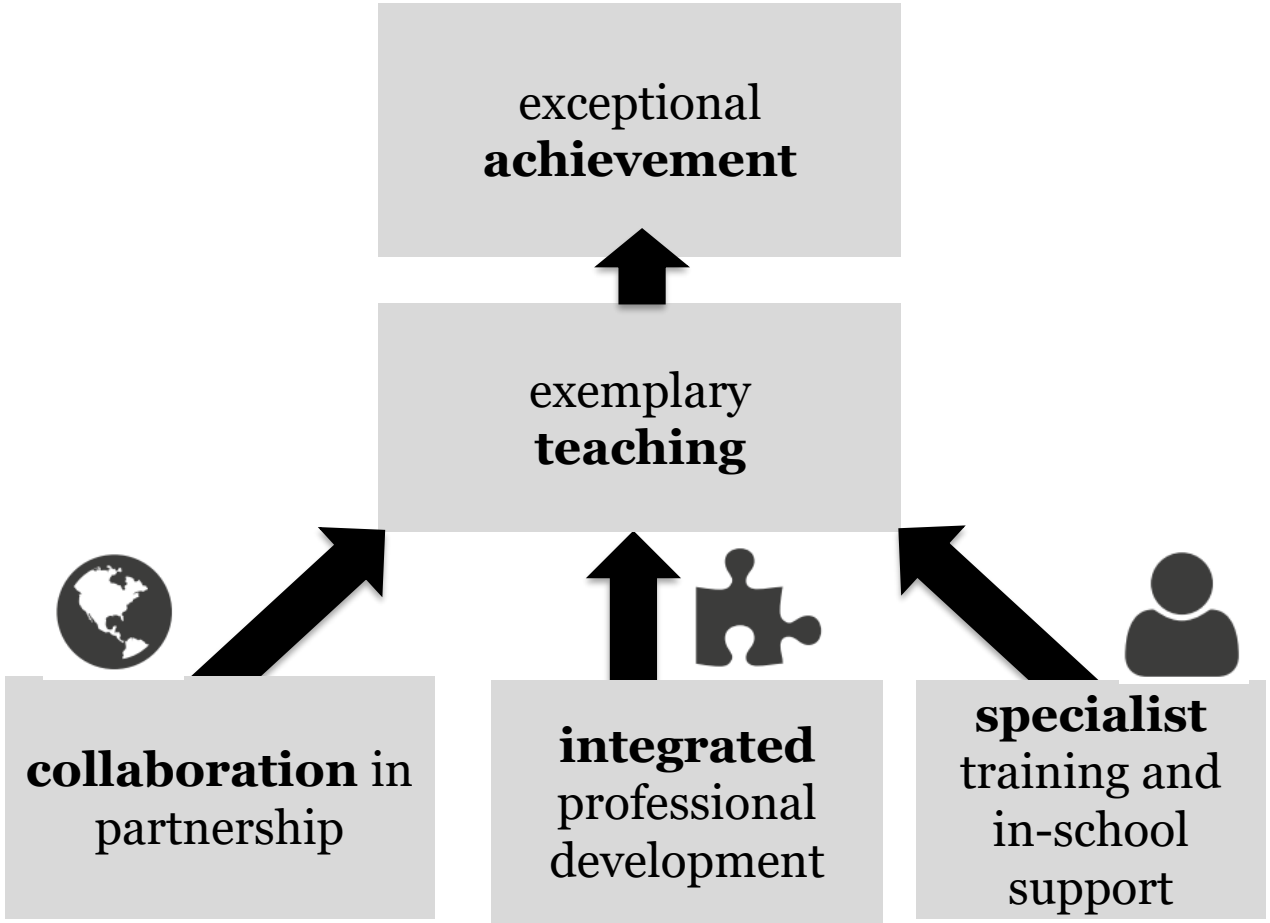
Mathematics Mastery

Parental Information

The Mathematics Mastery partnership approach



Our shared vision

- Every school leaver to achieve a strong foundation in mathematics, with no child left behind
- A significant proportion of pupils to be in a position to choose to study A-level and degree level mathematics and mathematics-related sciences

A belief and a frustration

Mastery member schools wanted to ensure that their aspirations for every child's mathematics success become reality

- Success in mathematics for every child **is possible**
- Mathematical ability is not innate, and is **increased through effort**

Effort-based ability – growth mindset

Intelligence can grow

Effort leads to success

When the going gets tough … I get smarter

I only need to believe in myself

Success is the making of targets

When the going gets tough … dig in and persist

Innate ability

Intelligence is fixed

Ability leads to success

When the going gets tough … I get found out

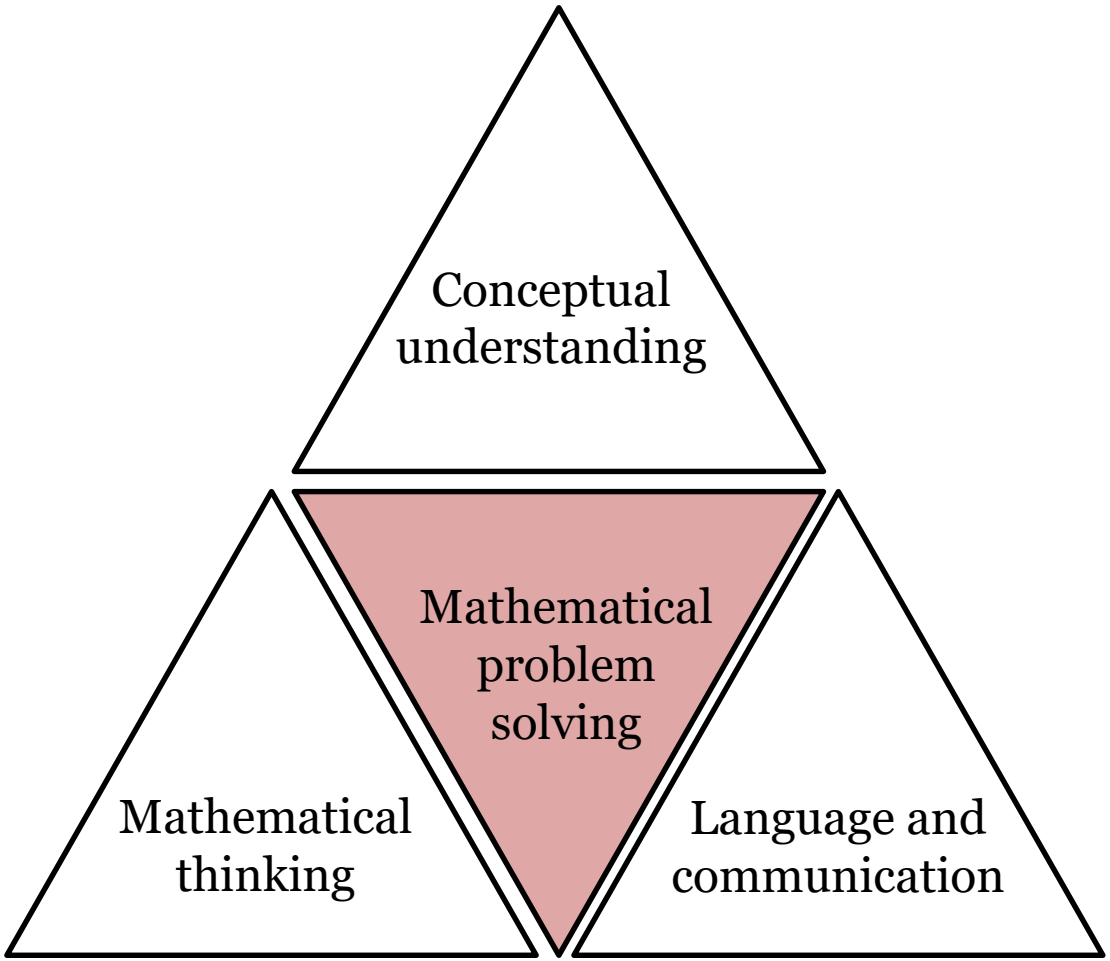
I need to be viewed as able

Success is doing better than others

When the going gets tough … give up, it's hopeless

Mathematics Mastery

Our approach



National Curriculum 2014

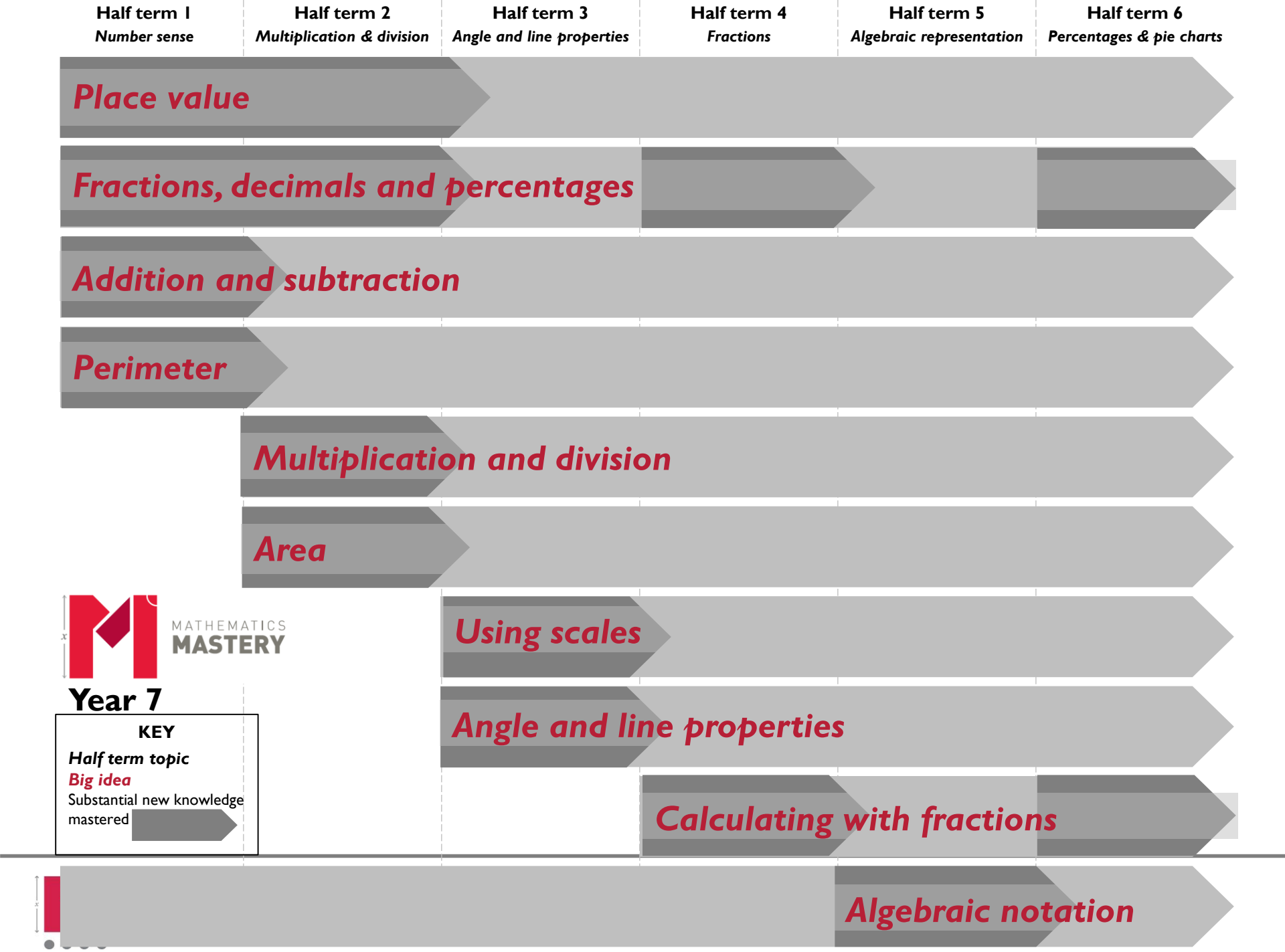
"Decisions about progression should be based on the security of pupils' understanding and their readiness to progress to the next stage. **Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content in preparation for key stage 4.** Those who are not sufficiently fluent should consolidate their understanding, including through additional practice, before moving on"

Curricular principles

- Fewer topics in greater depth
- Mastery for all pupils
- Number sense and place value come first
- Problem solving is central

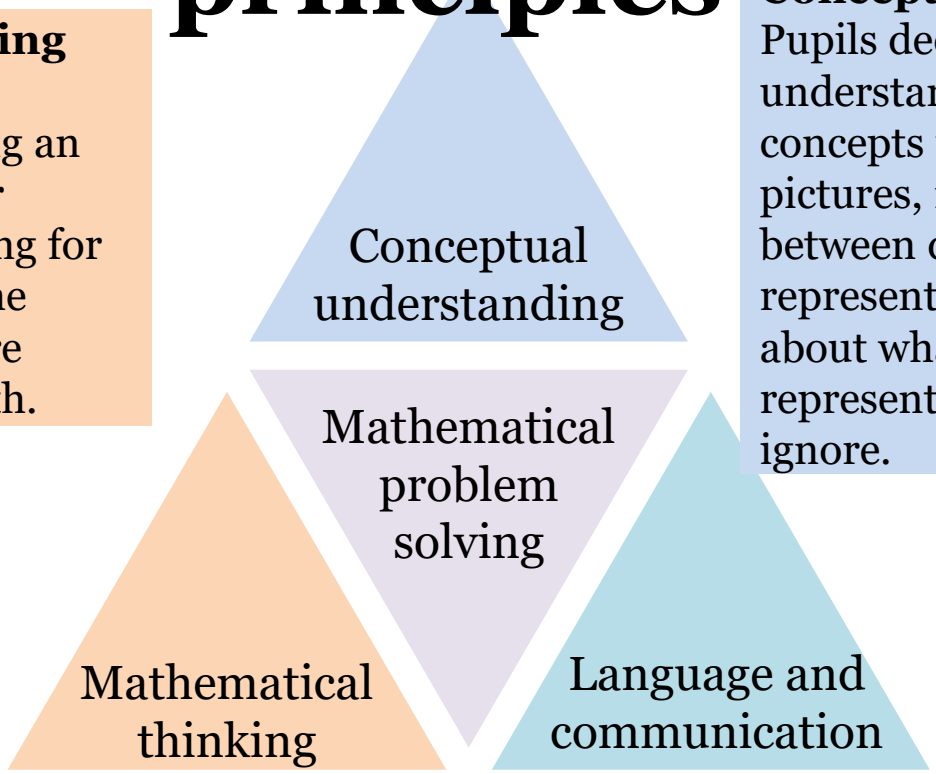
Y7 differentiation through depth

Autumn 1 Solve Word Problems (Add and Subtract)	Autumn 2 Explain and Investigate (Multiply and Divide)	Spring 1 Geometry	Spring 2 Fractions	Summer 1 Applications of Algebra	Summer 2 Percentages and Statistics
All should be confident and competent in Key Stage 2 material. Review of these pre-requisites may be useful for each unit:					
• Number bonds • Converting units • Money +/- • Measurement	• Mental Strategies • Multiplication facts • Multiplication Strategies • Solving problems with the four rules of number	• Lengths and units • Parallel and perpendicular • Working with angles • Division and the mean	• Equal parts • Factors and multiples • Tenths and hundredths • Word problems • Fractional areas	• Areas of rectangles and triangles • Number patterns • Algebraic notation • Triangle and quadrilateral properties	• Four Rules – decimals and problem solving • Fractions of shapes • Equivalence • Order of operations
All will have access to this specific Key Stage 3 content:					
• Place value (inc. decimals) • Add and subtract (inc. decimals) • Estimation • Perimeter • Word problems	• Factors, HCF, multiples, LCM • Multiply and divide (inc. decimals) • Area of rectangle and triangle • Calculate the mean	• Draw, measure and name acute and obtuse angles • Find unknown angles (straight lines, at a point, vertically opposite) • Properties of triangles and quadrilaterals	• Equivalent fractions • Compare and order fractions and decimals • Change mixed numbers to improper fractions and vice versa • Fraction of a quantity • Multiply and divide fractions	• Order of operations • Substitution • Simplifying algebraic expressions • Solve word problems with expressions • Sequences (term-to-term, not nth term)	• Construct and interpret statistical diagrams including pie charts and • Convert between percentages and fractions and decimals • Percentage of a quantity • Find the whole given the part and the percentage
As well as looking at the Termly Projects, highest attaining students may be stretched through depth by consideration of the following:					
• Different counting systems/bases • Generalisation • Upper and lower bounds	• Shikaku • Different counting systems/bases • Alternative methods for multiplication • Generalisation	• Tessellating triangles and quadrilaterals • Tangram investigations • Rigid shapes	• Terminating and recurring decimals • Fractions of tangrams • Shape block challenges	• Four fours • Patterns and generalising • Algebraic mean questions	• Comparing and converting between representations • Applications of percentages


Half term 1
Number sense
Half term 2
Multiplication & division
Half term 3
Angle and line properties
Half term 4
Fractions
Half term 5
Algebraic representation
Half term 6
Percentages & pie charts
Place value
Fractions, decimals and percentages
Addition and subtraction
Perimeter
Multiplication and division
Area
Using scales
Angle and line properties
Calculating with fractions
Algebraic notation
MATHEMATICS MASTERY
Year 7
KEY
Half term topic
Big idea
Substantial new knowledge mastered

Mathematics Mastery key principles

Mathematical thinking
Pupils deepen their understanding by giving an examples, by sorting or comparing, or by looking for patterns and rules in the representations they are exploring problems with.



Conceptual understanding
Pupils deepen their understanding by representing concepts using objects and pictures, making connections between different representations and thinking about what different representations stress and ignore.

Language and communication
Pupils deepen their understanding by explaining, creating problems, justifying and proving using mathematical language. This acts as a scaffold for their thinking deepening their understanding further.

Mastering mathematical understanding

Concrete-Pictorial-Abstract (C+P+A) approach

Concrete - DOING

At the concrete level, tangible objects are used to approach and solve problems. Almost anything students can touch and manipulate to help approach and solve a problem is used at the concrete level. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

Pictorial - SEEING

At the pictorial level, representations are used to approach and solve problems. These can include drawings (e.g., circles to represent coins, tally marks, number lines), diagrams, charts, and graphs. These are visual representations of the concrete manipulatives. It is important for the teacher to explain this connection.

Abstract –SYMBOLIC

At the abstract level, symbolic representations are used to approach and solve problems. These representations can include numbers or letters. It is important for teachers to explain how symbols can provide a shorter and efficient way to represent numerical operations.

What are manipulatives?

Bead strings

Dienes blocks

Fraction towers

Cuisenaire rods

Multilink cubes

Bar models

100 grids

Number lines

Shapes

Do the maths!

- Jake is 3 years older than Lucy and 2 years younger than Pete.

- The total of their ages is 41 years old.

Find Jake's age.

What else can you find?

Mastering mathematical thinking

***"Mathematics can be terrific fun; knowing that you can enjoy it is psychologically and intellectually empowering."* (Watson, 2006)**

We believe that pupils should:

- explore, wonder, **question** and conjecture
- **compare**, classify, sort
- experiment, play with possibilities, **modify** an aspect and see what happens
- make theories and predictions and act purposefully to see what happens, **generalise**

Mathematics Mastery Key Principles

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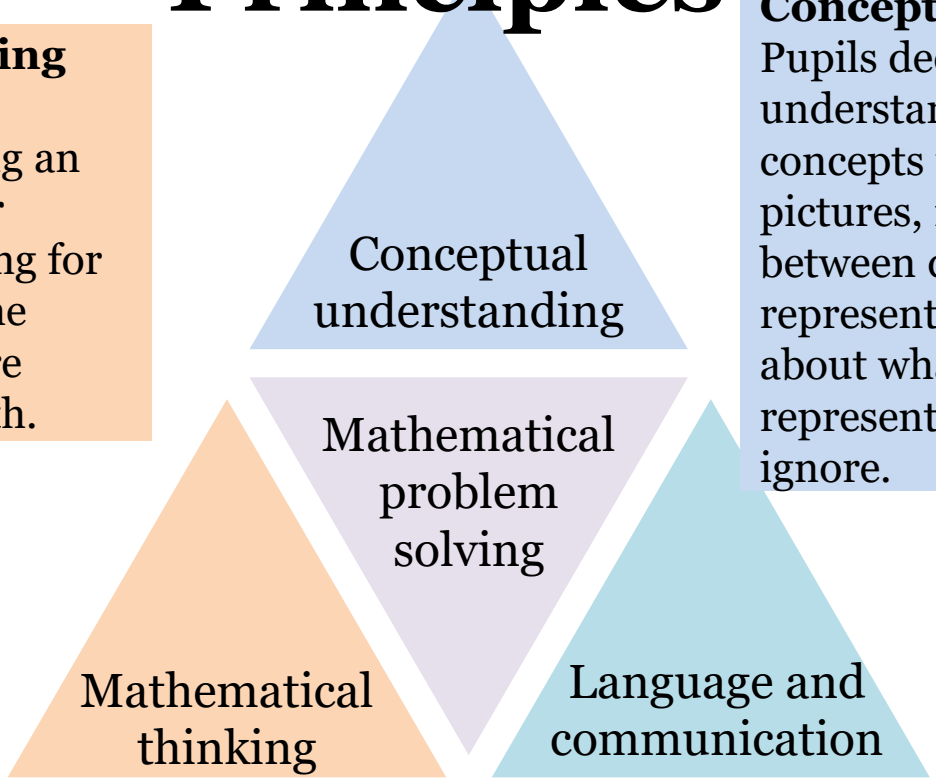

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Vocabulary – Multiple Meanings

Foot

Cancel

Odd

Translate

Mean

Prime

Power

Root

Share

Roughly

Product

Take Away

Volume

What number is half of 6?

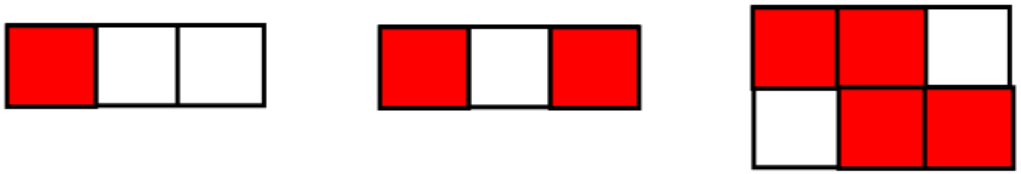
6 is half of what number?

Fractions – a "talk task"

Fraction representation

Which is the odd one out?

Why?



Can you find a way to make each shape the odd one out?

How?

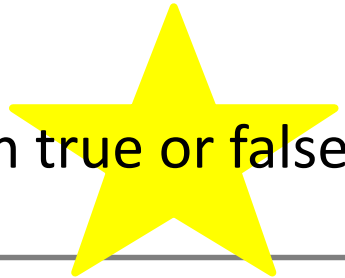
Challenging high attainers

- What number is 70 hundreds, 35 tens and 76 ones?
- Which is bigger, 201 hundreds or 21 thousands?
- How many bags each containing £10 000 do you need to have £3 billion?
- How many ways can you find to show/prove your answers?

True or False?

$$\begin{array}{r} ABC \\ DEF \\ +\ GHI \\ \hline \end{array} = \begin{array}{r} DEI \\ GHC \\ +\ ABF \\ \hline \end{array}$$

$$\begin{array}{r} ABC \\ DEF \\ +\ GHI \\ \hline \end{array} = \begin{array}{r} BAC \\ EFD \\ +\ IGH \\ \hline \end{array}$$



Can you make your own true or false statements like these?

Does it work?

The study shows that children who were taught through the Singaporean 'maths mastery' approach learn faster than their classmates

RICHARD GARNER | EDUCATION EDITOR | Thursday 18 June 2015

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THE INDEPENDENT

The first conclusive proof that Far Eastern teaching methods can improve UK pupils' maths performance is revealed in research just published.

A study, by UCL Institute of Education and Cambridge University, shows that children who were taught through the Singaporean "maths mastery" approach learn faster than their classmates - making, on average, an extra month of progress in a calendar year.

Farm

theguardian
Winner of the Pulitzer prize 2014

English pupils' maths scores improve under east Asian approach

Study shows 'maths mastery' experiment improved children's scores in English schools after just one year

What would OfSTED think?

Evidence from successful schools:

- Pupil collaboration and discussion of work
- Mixture of group tasks, exploratory activities and independent tasks
- Focus on concepts, not on teaching rules
- All pupils tackled a wide variety of problems
- Use of hands on resources and visual images
- Consistent approaches and use of visual images and models
- Importance of good teacher subject-knowledge and subject-specific skills
- Collaborative discussion of tasks amongst teachers