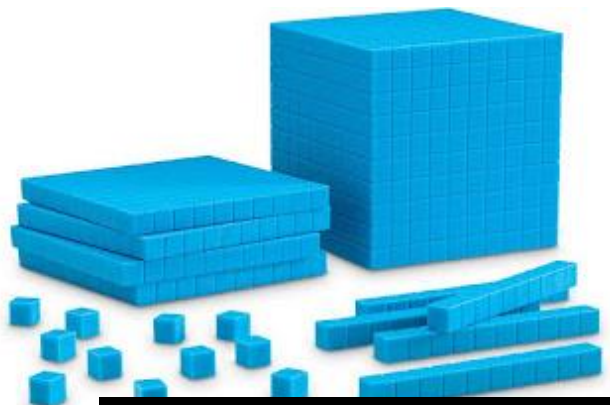


**Use of Manipulatives
in Mathematics at
Aston St. Mary's**



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At Aston St. Mary's, mathematical understanding is developed using a CPA (Concrete, Pictorial, Abstract) approach. This approach enables children to develop a deeper and more sustainable understanding of Mathematics. Manipulatives – or practical apparatus – play a key role in lessons across the school. These resources might include: Multilink cubes, Dienes apparatus, counters, place value counters, bead strings, Cuisenaire rods, tens frames, counting sticks, dice, hundred squares, dominoes etc. These practical resources, that children can pick up and manipulate, help enable children to get to grips with the abstract notions of numbers and the relationships between them. Children also learn to use pictorial representations alongside their use of concrete resources in order to deepen their understanding of abstract calculations.

EYFS



Pupils in EYFS use a wide range of manipulatives to support their learning in all areas of Mathematics.



Year One

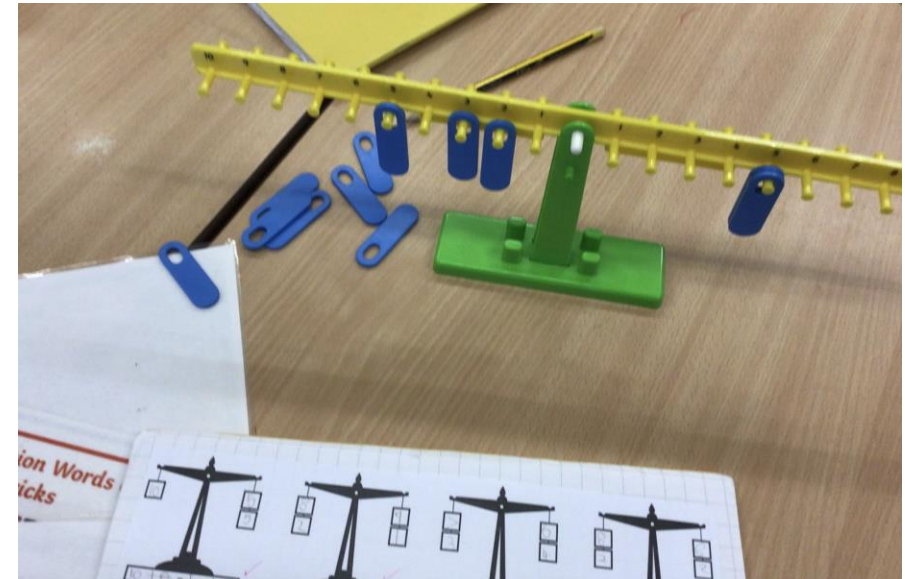
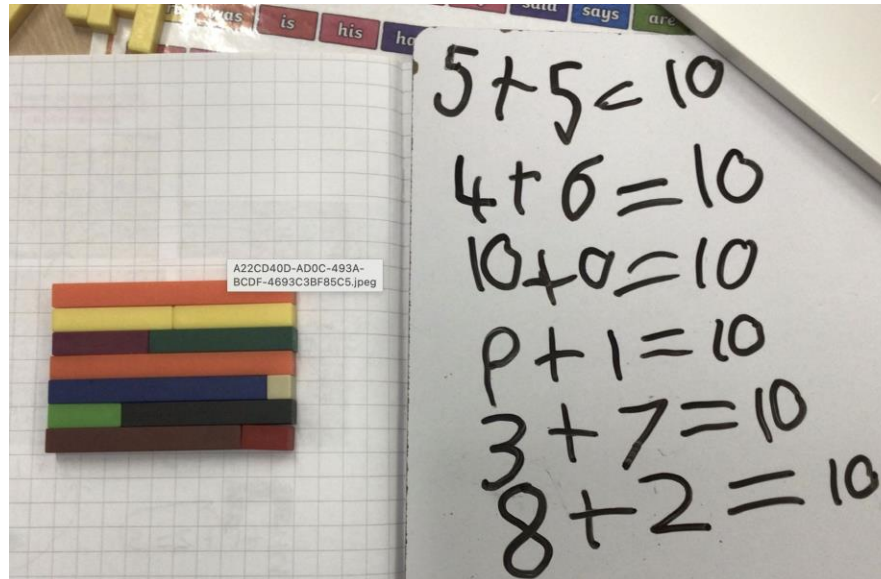


In Year One, children begin to develop their understanding of multiplication by doubling numbers and quantities. Multilink cubes enable them to build models and count before recording as number sentences.



Balance scales are used to explore children's understanding of equality.

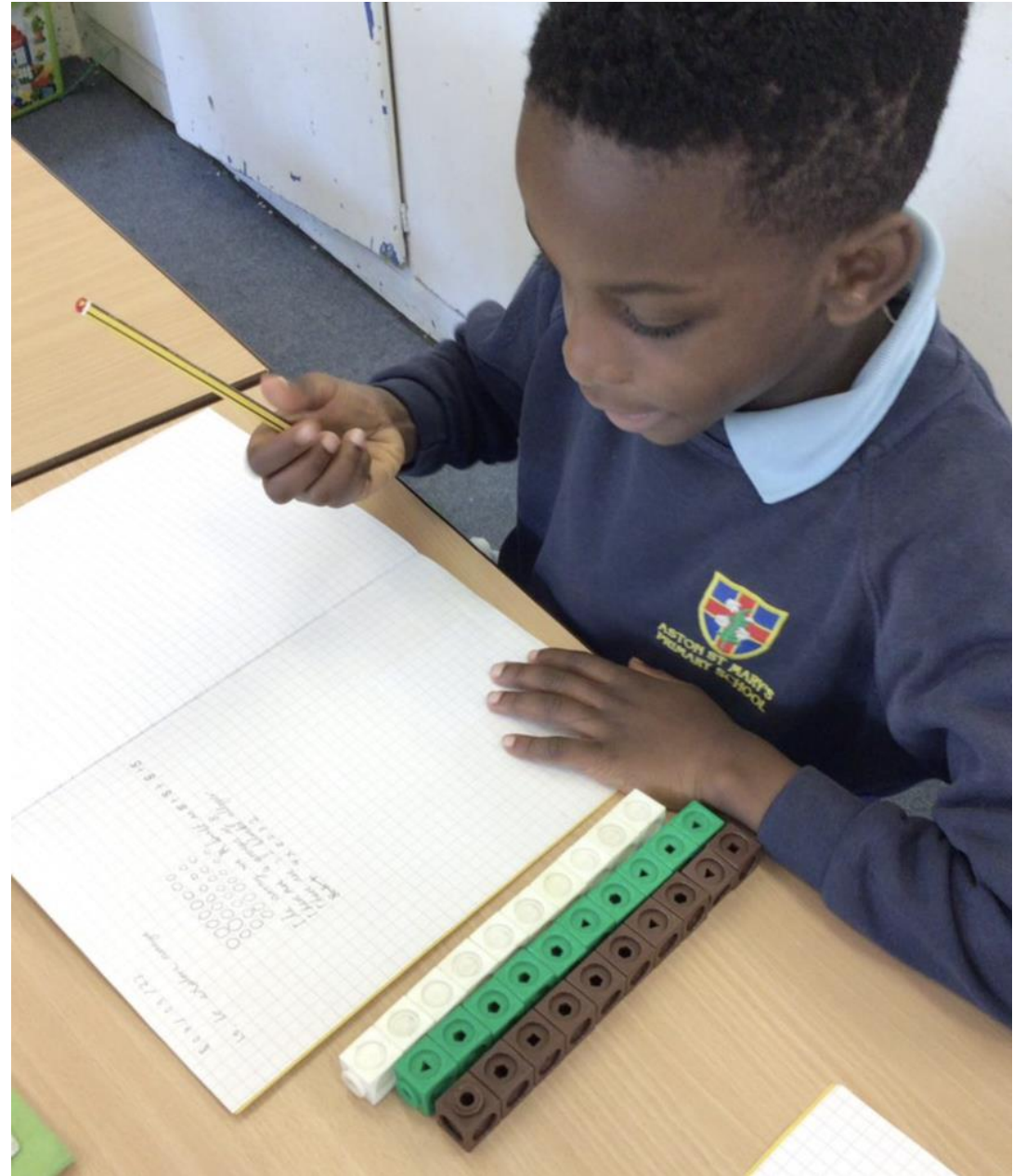
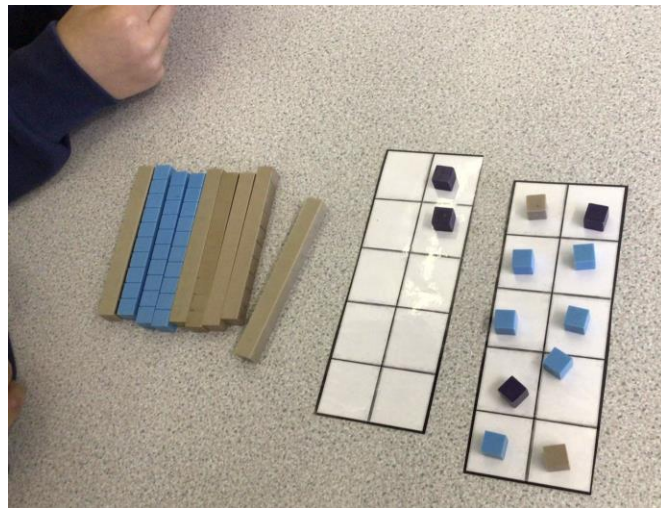
Cuisenaire rods are used to investigate number bonds to ten and twenty. Children learn to represent these using +, - and =.



Year Two

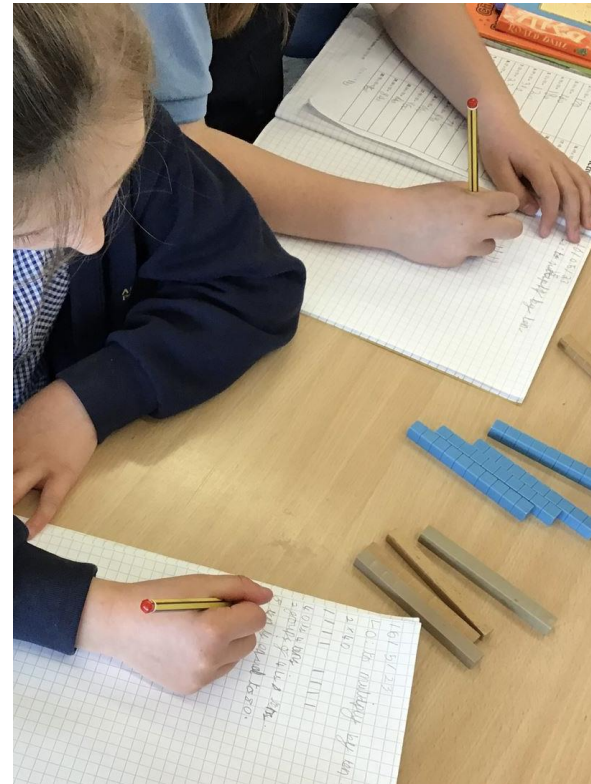
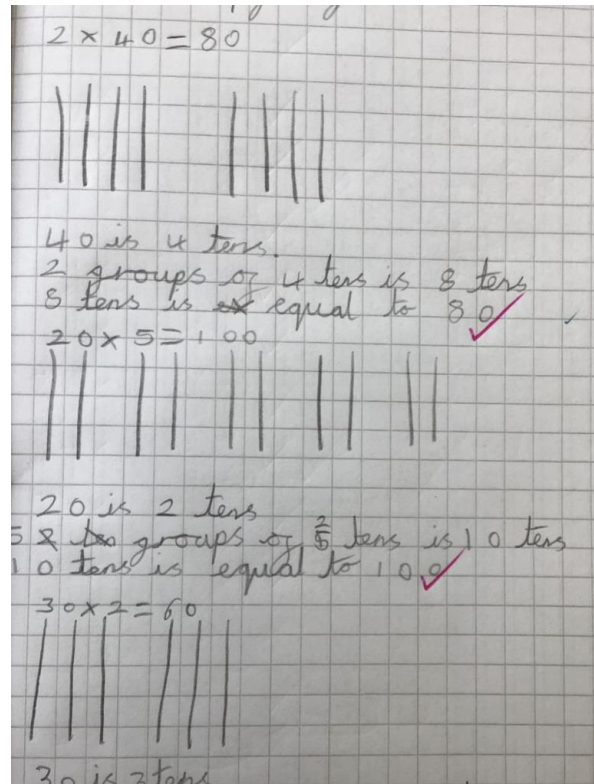
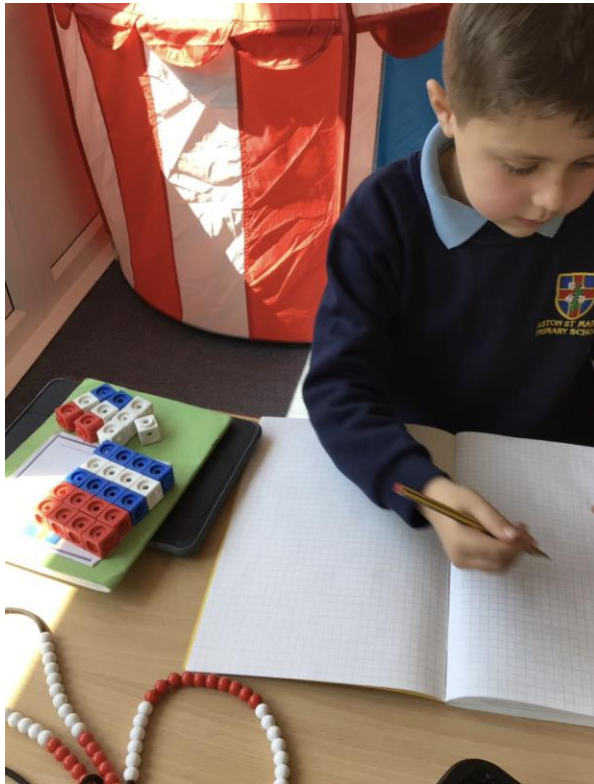
During Year Two, children secure their understanding of the value of each digit in two-digit numbers. Tens frames and Dienes apparatus are used to embed their understanding.

Children learn to recall and use their multiplication and division facts in the 2x, 5x and 10x tables; they use multilink to build arrays, share and group numbers. Children also learn to represent their use of manipulatives pictorially when recording their learning.



Year Three

As children move into Key Stage Two, they extend their understanding of place value to apply to three-digit numbers. They continue to build upon their knowledge and understanding of multiplication and division facts to include 3, 4 and 8 multiplication tables. Using familiar manipulatives such as Dienes, Multilink and bead strings, they learn to apply their understanding in order to multiply by multiples of ten. They are now confident in the use of pictorial representations to represent their calculations.



Year Four



21.03.23
LO: add and subtract fractions with no regrouping

What is the result when you add $\frac{3}{5}$ and $\frac{2}{5}$ together?

$\frac{3}{5} + \frac{2}{5} = \frac{5}{5}$

The result is $\frac{5}{5}$

If you eat $\frac{3}{6}$ of a pizza and your friend eats $\frac{2}{6}$ of it, how much pizza have you eaten between you? How much pizza is left?

You have eaten $\frac{5}{6}$
There is $\frac{1}{6}$ of pizza left

$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

James went out for a long walk. He walked $\frac{6}{8}$ mile and then sat down to take a rest. Then he walked $\frac{1}{8}$ of a mile. How far did he walk altogether?

He walked $\frac{7}{8}$ of a mile

$\frac{6}{8} + \frac{1}{8} = \frac{7}{8}$



21.03.23
LO: add and subtract fractions with no regrouping

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If you eat $\frac{3}{6}$ of a pizza and your friend eats $\frac{2}{6}$ of it, how much pizza have you eaten between you? How much pizza is left?

$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$ $\frac{1}{6}$ left

$\frac{1}{10}$ of the M&M's in a bag are red and $\frac{2}{10}$ are blue. What fraction of all the M&M's are red and blue?

$\frac{1}{10} + \frac{2}{10} = \frac{3}{10}$

James went out for a long walk. He walked $\frac{6}{8}$ mile and then sat down to take a rest. Then he walked $\frac{1}{8}$ of a mile. How far did he walk altogether?

$\frac{6}{8} + \frac{1}{8} = \frac{7}{8}$

Peter loves biscuits. On Monday, he eats $\frac{2}{9}$ of a packet. On Tuesday, he eats $\frac{4}{9}$ of a packet. What fraction of the packet of biscuits does he eat altogether?

$\frac{2}{9} + \frac{4}{9} = \frac{6}{9}$

Tim and Sarah are painting old chairs. They use $\frac{3}{12}$ of a tin of paint on one chair and $\frac{5}{12}$ of a tin on another. What fractions of the tin of paint did they use altogether?

$\frac{3}{12} + \frac{5}{12} = \frac{8}{12}$

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In Year Four, children learn to add and subtract fractions with the same denominator. They develop their understanding by using manipulatives, such as multilink cubes. Here, they represent the 'whole' by referring to the denominator – this tells them how many cubes to use for the 'whole'. Different coloured cubes can then be used to represent the information in the worded problem. Pictorial representations also support the childrens' understanding before they are ready to move to abstract, written calculations.

Year Five

During Year Five, pupils develop their understanding of percentages. They use multilink rods to represent 100% with each cube representing 10%. As they move onto calculating percentages of quantities, they are able to assign a value to each cube and then represent these pictorially as bar models.

LO: To explore square numbers, make conjectures and generalisations

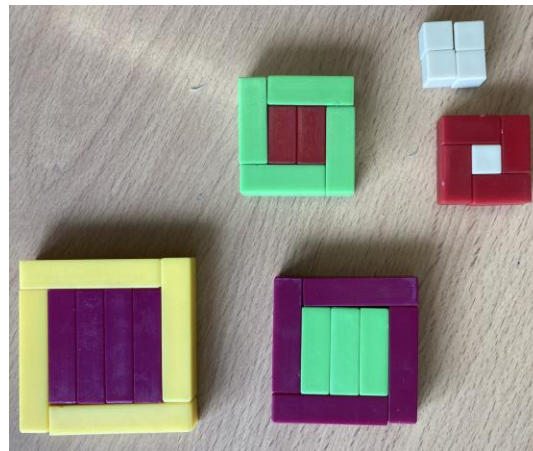
Each square gets bigger.

They are all squares

- They are all different
- It starts as a white one, that colour is in the middle of the red, the red is in the middle of the green, the green is in the middle of the pink. ✓
- The outside always uses 4 rods ✓
- The middle always gets bigger by one rod ✓

LO met.

Children use Cuisenaire to investigate square numbers. They are able to identify the growing pattern and make observations, conjectures and generalisations.



LO: To use bar models to calculate percentages

$40\% \times 80 = 32\%$

80

90

$70\% \times 60 = 42$

60

$90\% \times 40 = 36$

40

$70\% \times 130 = 91$

130

$60\% \times 240 = 144$

240

$80\% \times 170 = 136$

170

$30\% \times 310 = 93$

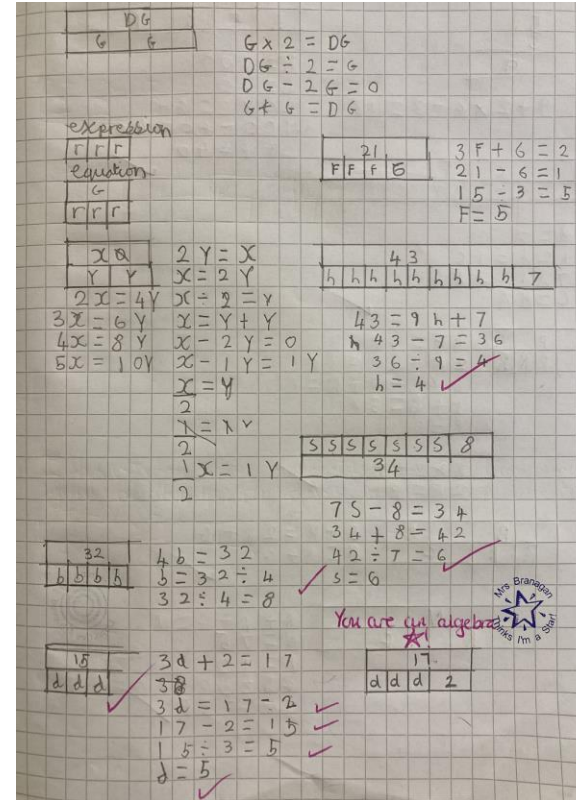
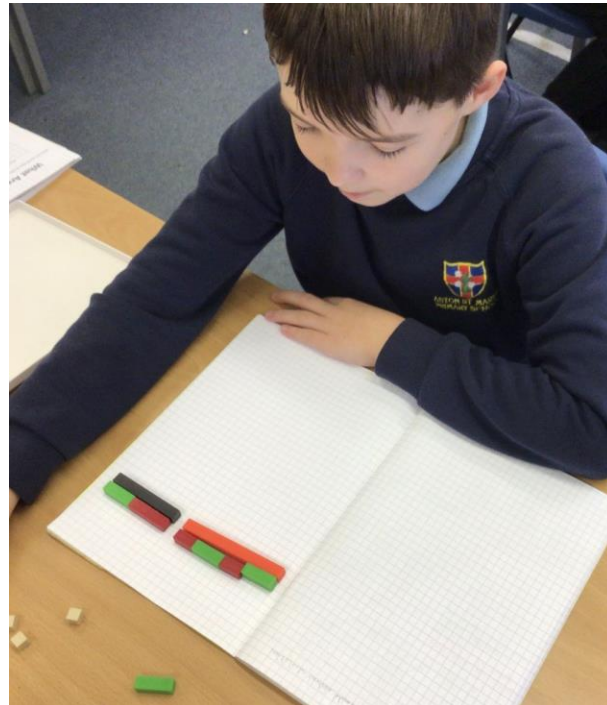
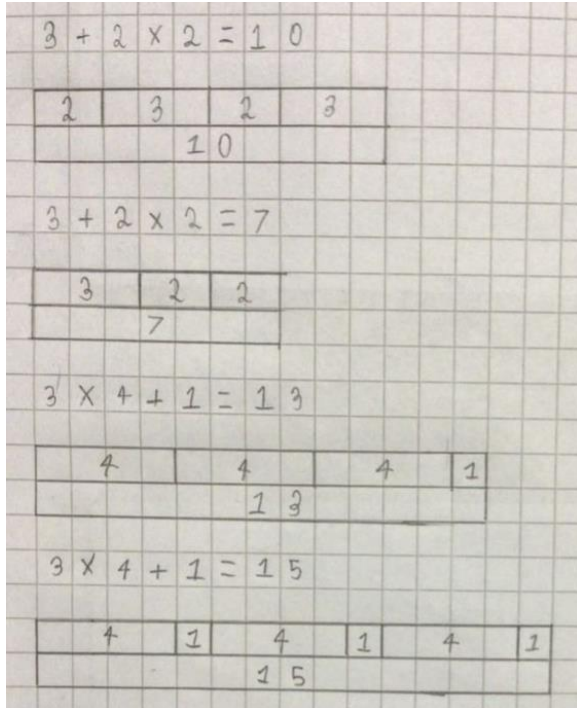
310

This lesson was really fun and I really like to use bar models!

Self-assessed work

Year Six

During Year Six, pupils use Cuisenaire to explore their understanding of the order of operations. They learn to represent these pictorially and then apply BIDMAS to solve calculations involving the four operations.



Cuisenaire is also used to develop pupils' algebraic reasoning. They learn to use simple formulae and model these using Cuisenaire. Again, they move on to draw pictorial representations to express missing number problems algebraically.

