

Route Towards a Formal Written Method for Addition – Year 2

National Curriculum Programme of Study;

Add numbers using concrete objects and pictorial representations, including:

- A two digit number and ones
- A two digit number and tens
- Two two-digit numbers
- Adding three one-digit numbers

Show that addition of two numbers can be done in any order (commutative).

[Non-statutory - Recording addition in columns supports place value and prepares for formal written methods with larger numbers.]

BY THE END OF YEAR 2...

Children will be confident in using a range of base 10 equipment in columns. They will be able to add two 2-digit numbers and start to record the value of the digits on the baseboard in the tens and units columns.

Using grouped objects for addition, without recombining

Once secure with the understanding of place value for two-digit numbers, teachers should demonstrate, using concrete objects grouped in tens, how numbers can be represented on base boards (A3 in size) and then used for calculating.



'Familiar' objects should be used initially. Balloons packaged into boxes of ten are ideal, and they clearly show the number contained on the labelling. Discuss the contents and count the contents of a box with the children. Discuss the value of the single balloons as both 'units' and 'ones'.

Show how a number such as 23 can be represented using the balloons. *How many packs of ten balloons can we use? How many balloons will that be? How many single balloons will we need to make our total?*

We also have 12 balloons. Write the addition calculation ' $23 + 12$ '. Ensure the units do not add to more than 9, and thus won't need to be recombined. *How can we show the extra 12 balloons?* (One pack of ten and 2 single balloons). Place the 23 balloons and the 12 balloons on the baseboard, directly underneath each other.



Demonstrate how to combine the single balloons first, using the vocabulary of addition, bringing them to the bottom of the board. Bring the packs of ten balloons down in the same way. Allow the children to determine how to calculate the total number of balloons, encouraging the use of 'tens and ones/units' vocabulary. Model the counting in tens for the packs of balloons, and in ones for the single balloons.



Once secure, teachers can annotate the base board alongside the concrete objects. This starts to link to the next stage in the progression towards a formal written method, where calculations are laid out vertically.

Try to integrate the inverse operation of subtraction as much as possible. *How many would we have left if we subtracted 12 from our total? How do you know? What if we subtracted 23?* Demonstrate this on the base board by moving the balloons back up the grid, from the answer bar.

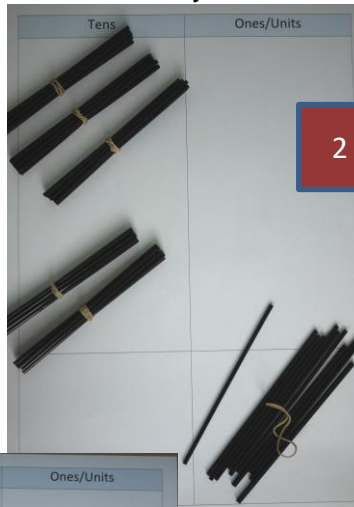
Using grouped objects for addition, with recombining

Once children are secure with the concept of combining the grouped objects for numbers that do not require re-grouping (i.e. units do not add to more than 9), then numbers can be chosen that will require re-grouping. Bundles of straws are the next step in the progression of being really secure with base-ten place value. They are easy to manipulate, yet allow the children to still see the 'ten-ness' of ten, allowing for simple regrouping.



Show '34 + 27'. Lay the grouped concrete objects (moving on to straws bundled into tens) onto the base ten board and discuss the value of the different groups in the same way as above.

Combine the them to the mental many single *What can we straws?* Explain the straws (using position these column. *What*

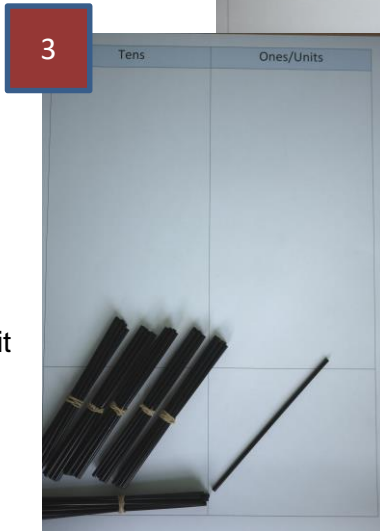


'units/ones' straws and move bottom of the grid. Use calculation skills to find how straws there are altogether. *do now that we have 11*

'regrouping' of ten of the an elastic band) and then at the bottom of the tens *do we need to do now?*

Bring the tens bundles grid. *How many straws do we*

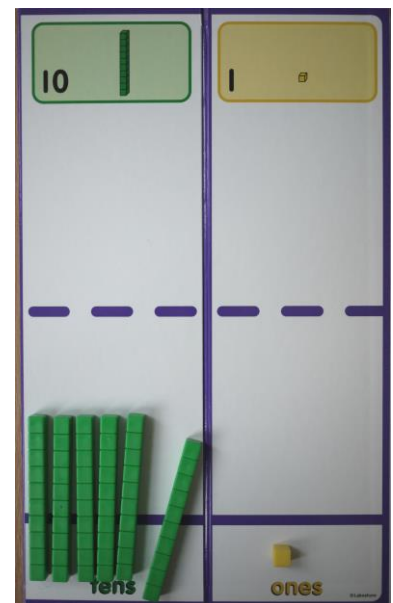
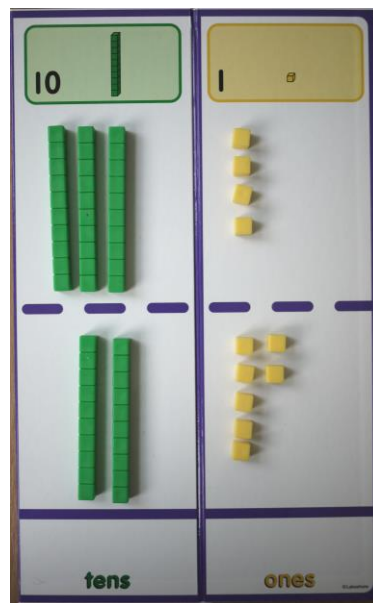
As before, the link with here, discussing what would were subtracted from the 27? Note that to demonstrate bundles would need to be split for subtraction), and so a need to take place.



down to the bottom of the *have altogether?*

subtraction can be integrated happen if 34 straws total. *What if we subtracted this, one of the straw (see decomposition careful discussion would*

Children working confidently with bundles of straws can move on to using Dienes base-ten equipment. This is also grouped in tens, but cannot be split apart or recombined easily, and requires an understanding of exchange. The Dienes equipment should be introduced alongside the straws, enabling the children to see what is the same and what is different.



Route Towards a Formal Written Method for Addition – Year 3

National Curriculum Programme of Study;

- Add numbers with up to three digits using formal written methods of columnar addition.

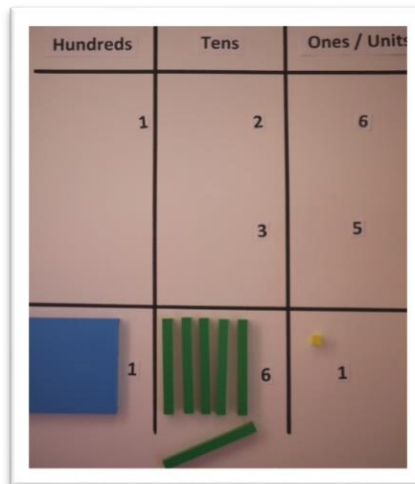
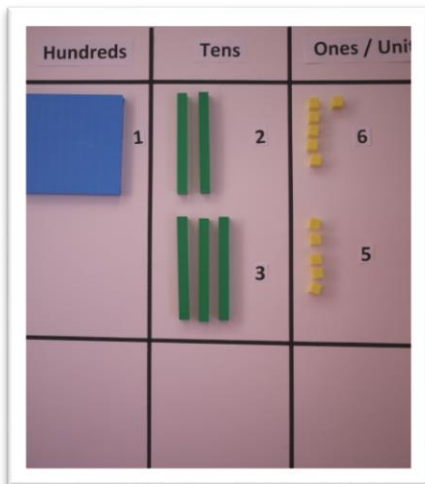
BY THE END OF YEAR 3...

By the end of Year 3, children will be able to show their understanding as;

$$\begin{array}{r}
 189 \\
 + 642 \\
 \hline
 831 \\
 \hline
 1 \quad 1
 \end{array}$$

Following on from year 2...

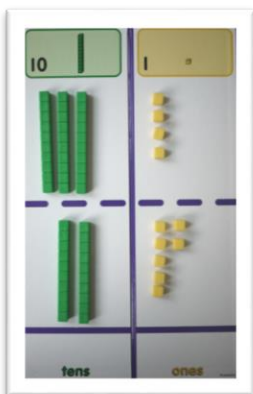
Using grouped objects for addition, with regrouping, and matched recording



Modelling the addition of two numbers (HTU + TU then HTU + HTU) using base 10 equipment (or bundles of straws) and a baseboard.

Introduction to formal column method

Once children have a secure conceptual understanding of the value of the digits in a calculation, and the relation of the annotated digits from the base board to the practical equipment, they can be moved on to a formal vertical written method for addition.

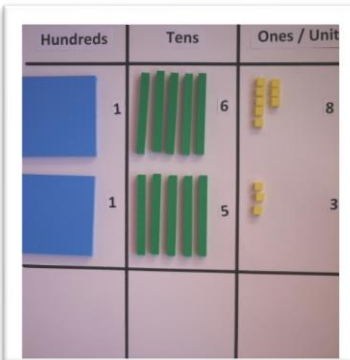


$$\begin{array}{r}
 34 \\
 + 27 \\
 \hline
 11 \\
 50 \\
 \hline
 61
 \end{array}$$

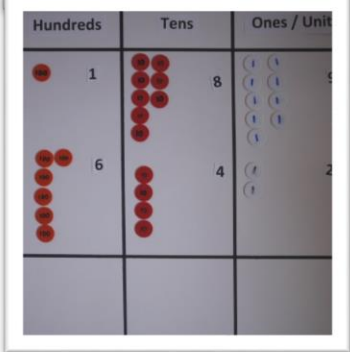
Show the children a 2-digit + 2-digit calculation using base 10 materials on a baseboard. *'What is my calculation? Which two numbers am I adding?'* Write the matching formal vertical calculation, alongside the baseboard.

Refer to the different parts of calculation, encouraging the children to see what is the same and what is different. Repeat the physical action with the practical resource as before. At each stage, complete the formal written algorithm alongside. Encourage children to compare the two representations. Ask questions such as; *'What has happened to my 11 ones/units? How is this shown with the equipment? How is it shown here?'*

As children's conceptual understanding is embedded adding two 2-digit numbers, they should be provided with more challenging questions. Numbers should be extended to HTU + TU, then HTU + HTU. Take care to choose the numbers for questions carefully, introducing examples without regrouping, before expanded method (above) with regrouping, and then into the formal compact method



$$\begin{array}{r} 168 \\ + 153 \\ \hline 321 \end{array}$$



$$\begin{array}{r} 189 \\ + 642 \\ \hline 831 \end{array}$$

Base 10 Dienes equipment can be substituted with 'Place Value counters' once children are completely secure in the value of the digits and the base ten nature of our number system. These should be introduced in the same way as other resources, making use of the baseboard and with careful modelling of using exchange when regrouping.

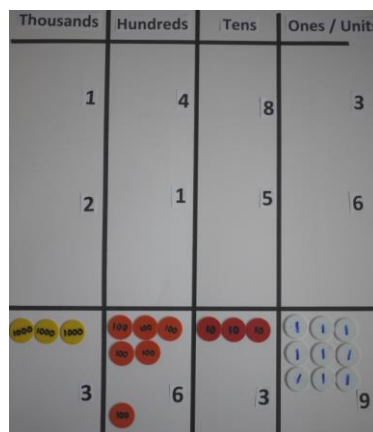
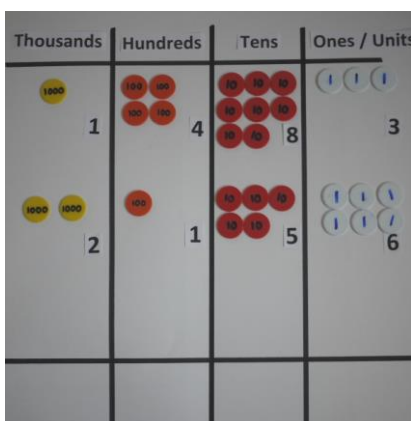
Route Towards a Formal Written Method for Addition – Year 4

National Curriculum Programme of Study;

- Add numbers with up to four digits using the formal written methods of columnar addition where appropriate.
- Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
- Solve simple measure and money problems involving fractions and decimals to two decimal places.

BY THE END OF YEAR 4...

By the end of Year 4, children will be able to show their understanding as;

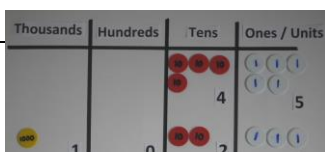


$$\begin{array}{r} 1483 \\ + 2156 \\ \hline 3639 \end{array}$$

Following on from year 3... Formal column addition, where appropriate

Children should continue to use the place value counters, in columns, to support their conceptual understanding of addition.

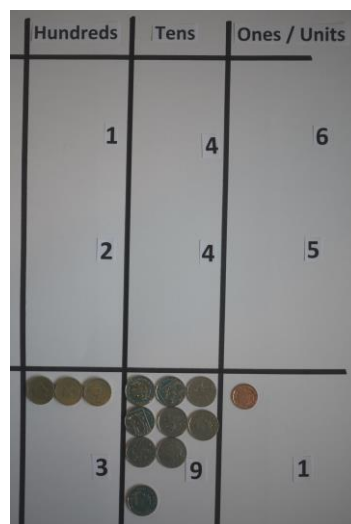
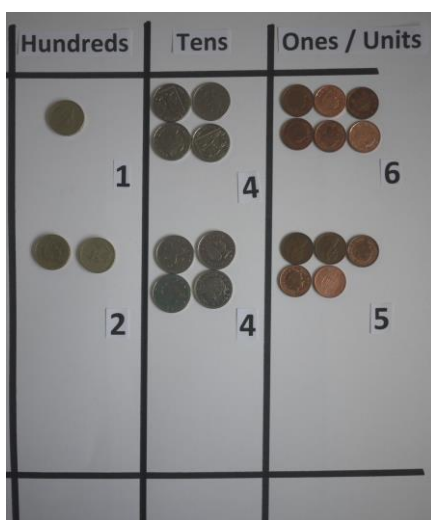
They should be expected to add several numbers, with different numbers of digits, and respond using column addition



$$\begin{array}{r}
 45 \\
 + 1023 \\
 \hline
 154 \\
 \hline
 1222 \\
 \hline
 11
 \end{array}$$

Apply understanding of addition in other contexts involving decimals

Use other practical resources such as coins (£1, 10p, 1p) and masses (100g, 10g, 1g) when adding in the context of measures (to 2 d.p.) Encourage children to explain their thinking in terms of the practical equipment, continuing to make use of the base board where appropriate.



$$£1.46 + £2.45$$

$$\begin{array}{r}
 1.46 \\
 + 2.45 \\
 \hline
 3.91 \\
 \hline
 1
 \end{array}$$

Route Towards a Formal Written Method for Addition – Year 5

National Curriculum Programme of Study;

- Add whole numbers with more than 4 digits, including using formal written methods (columnar addition).
- Solve problems involving numbers up to three decimal places.

BY THE END OF YEAR 5...

By the end of Year 5, children will be able to show their understanding as;

$$\begin{array}{r} 1\ 2\ 8\ 3\ 6 \\ +\quad 7\ 2\ 8\ 8 \\ \hline 2\ 0\ 1\ 2\ 4 \\ \hline 1\ 1\ 1\ 1 \end{array}$$

$$\begin{array}{r} 2\ 1\ .\ 3\ 0 \\ +\quad 9\ .\ 0\ 8 \\ \hline 3\ 0\ .\ 3\ 8 \\ \hline 1 \end{array}$$

Following on from Year 4...

Formal column addition, including addition of mixed decimal numbers in a range of contexts

Children should continue to use the place value counters, in columns, to support their conceptual understanding of addition and the place value of larger and smaller numbers (to 3 decimal places).

$$\text{£}10.38 + \text{£}2.85$$

$$\begin{array}{r} 1\ 0\ .\ 3\ 8 \\ +\quad 2\ .\ 8\ 5 \\ \hline 1\ 3\ .\ 2\ 3 \\ \hline 1\ 1 \end{array}$$

$$1.25\text{m} + 12\frac{1}{2}\text{m} + 37.5\text{cm}$$

$$\begin{array}{r} 1\ .\ 2\ 5 \\ +\ 1\ 2\ .\ 5\ 0 \\ \hline 0\ .\ 3\ 7\ 5 \\ \hline 1\ 4\ .\ 1\ 2\ 5\ \text{m} \\ \hline 1\ 1 \end{array}$$

Route Towards a Formal Written Method for Addition – Year 6

National Curriculum Programme of Study;

- Pupils practise addition for larger numbers using the formal written methods of columnar addition.
- Solve addition one step and multi-step problems in context.

BY THE END OF YEAR 6...

By the end of Year 6, children will be able to show their understanding as;

$$\begin{array}{r} 302432 \\ + 110709 \\ \hline 413141 \\ \hline 1 1 \end{array}$$

$$\begin{array}{r} 106.035 \\ 2.8 \\ 23.38 \\ + 210.124 \\ \hline 342.339 \\ \hline 1 1 1 \end{array}$$