Year 3 Maths Calculations Policies

National Curriculum Programme of Study:

- Add numbers with up to three digits using formal written methods of columnar addition.
- Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent (non-statutory).
- Pupils practise solving varied addition and subtraction questions (non-statutory).

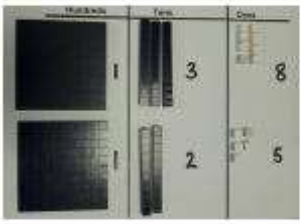
Y3
Addition

BY THE END OF YEAR 3…
By the end of Year 3, children will be able to show their understanding as:

$$\begin{array}{r} 1\ 8\ 9 \\ +\ 6\ 4\ 2 \\ \hline 8\ 3\ 1 \\ \hline {}_{1\ 1\ \ } \end{array}$$

Following on from year 2…
Using grouped objects for addition, with regrouping, and matched recording






Continue the good practice from Year 2, modelling the addition of two numbers (HTO + TO then HTO + HTO) using base 10 equipment. The value of the digits should be added to the grid throughout the calculation, to enable children to see the links between the practical model and the formal written method.

Continue to integrate the concept of addition and subtraction being the inverse of each other with questions such as; *'If I have 161 in my answer at the bottom of the grid, what might my grid have looked like at the start?' 'Can you find an example where I wouldn't need to regroup?'*

Recording in books:
138 + 125 =

$$\begin{array}{rl} & 100 + 30 + 8 \\ + & \underline{100 + 20 + 5} \\ & 200 + 50 + 13 = 263 \end{array}$$

Expanded Addition

$$\begin{array}{r} 138 \\ +\ 125 \\ \hline 200 \\ 50 \\ +\ 13 \\ \hline 263 \end{array}$$

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 grid to the practical equipment, they can be moved on to a formal vertical written method for addition.

Initially this should be done alongside the practical model, and children should be encouraged to discuss 'what is the same and what is different'.

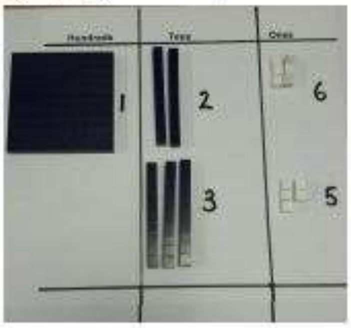
Expanded Addition

	3	4
+	2	7
	1	1
	5	0
	6	1

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

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? How is this shown with the equipment? How is it shown here?'*

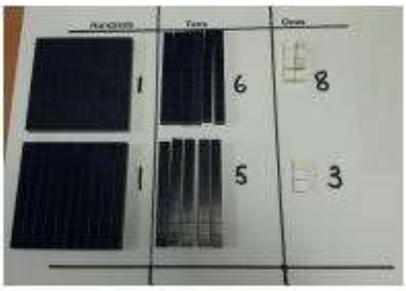
As children's conceptual understanding is embedded adding two 2-digit numbers, they should be provided with more challenging questions. Numbers should be extended to HTO + TO, then HTO + HTO. Take care to choose the numbers for questions carefully, introducing examples without regrouping, before expanded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



	1	2	6
+		3	5
		1	1
		5	0
	1	0	0
	1	6	1

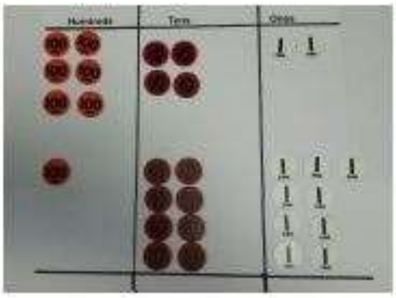
Compact Addition

	1	2	6
+		3	5
	1	6	1
		1	



	1	6	8
+	1	5	3
		1	1
	1	1	0
	2	0	0
	3	2	1

	1	6	8
+	1	5	3
	3	2	1
	1	1	



$$\begin{array}{cccc} & 6 & 4 & 2 \\ + & 1 & 8 & 9 \\ \hline & 8 & 3 & 1 \\ \hline & {\scriptstyle 1} & {\scriptstyle 1} & \end{array}$$

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 grid and with careful modelling of using exchange when regrouping.

Note it is good practice to place higher value numbers first, i.e. 642 + 189 rather than 189 + 642.

National Curriculum Programme of Study:

- subtract numbers with up to three digits, using formal written methods of columnar subtraction

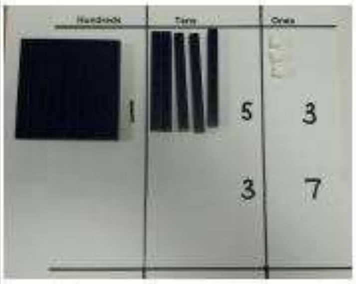
Y3
Subtraction

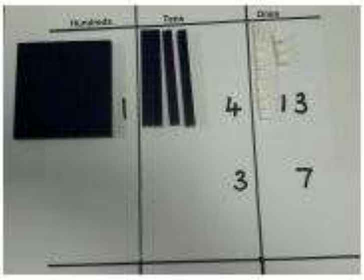
BY THE END OF YEAR 3…
By the end of Year 3, children will be able to show their understanding as:

$$\begin{array}{rccc} & {}^{8}\not{9} & {}^{1}{}^{2}\not{3} & {}^{1}2 \\ - & 4 & 5 & 7 \\ \hline & 4 & 7 & 5 \end{array}$$

Following on from year 2…
Using grouped objects for subtraction, with exchanging, and matched recording

Continue the good practice from Year 2, modelling the subtraction of two numbers (HTO – TO, then HTO - HTO) using base 10 equipment and grid. (Use straws for those who struggle with exchange).





In the example here, showing 153 – 37, the equipment is placed on the grid, with annotated digits alongside.
Discuss the fact that there are not enough separate ones to subtract 7 easily, so you will need to exchange a ten for ten ones.

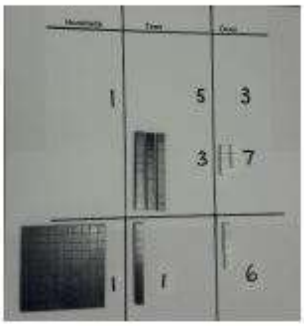
Reinforce that this number can now be read as *'one hundred and forty and thirteen'*.

Once the exchange is made, the 7 ones can be subtracted (moved down), followed by the 3 tens. The remaining equipment is brought down to the bottom of the grid, to the answer bar. The value of the digits should be written on the grid throughout the calculation, to enable children to see the links between the practical model and the formal written method.

Initially, calculations should only involve exchanging between the tens and ones.

The formal written method should be introduced alongside the annotated grid displaying the apparatus, and children should be encouraged to find the similarities at all stages. Refer to each part of the calculation and ensure the children make links between the two representations. *How have I shown the one ten exchanged for ten ones in the written method? Why have I changed the 5 to a 4 in the tens column? How did this look with the practical equipment?*

$$\begin{array}{rccc} & 1 & {}^{4}\not{5} & {}^{1}3 \\ - & & 3 & 7 \\ \hline & 1 & 1 & 6 \end{array}$$

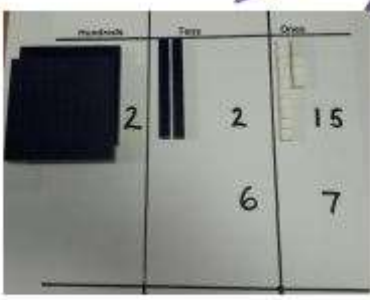


Using grouped objects for subtraction, with exchanging

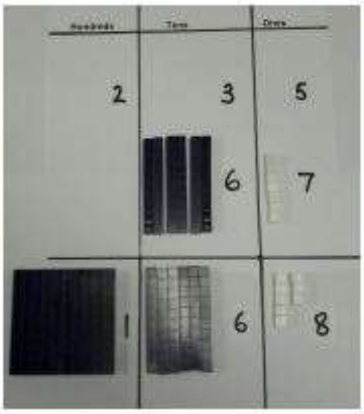
Continue to integrate the concept of addition and subtraction being the inverse of each other with questions such as; '*If I had 116 in my answer bar at the bottom of the grid, and I had subtracted 37 as we have done here, what must my starting number have been? Did I still need to exchange?*'

Once confident, children should be introduced to examples requiring exchange from hundreds to tens as well as tens to ones, such as 235 - 67 shown here.

'two hundred and twenty and fifteen, subtract sixty seven'



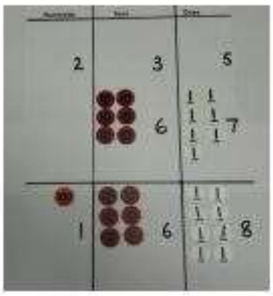
'one hundred and twelve tens and fifteen, subtract sixty seven'



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 exchange.

$$\begin{array}{rrrr} & ^{1}\not{2} & ^{12}\not{3} & ^{1}5 \\ - & & 6 & 7 \\ \hline & & & 8 \\ & & 6 & 0 \\ & 1 & 0 & 0 \\ \hline & 1 & 6 & 8 \end{array}$$

$$\begin{array}{rrrr} & ^{1}\not{2} & ^{12}\not{3} & ^{1}5 \\ - & & 6 & 7 \\ \hline & 1 & 6 & 8 \end{array}$$



National Curriculum Programme of Study:

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Y3

Multiplication

BY THE END OF YEAR 3…

	3	6
x		7
	4	2
2	1	0
2	5	2

Expanded column written method, progressing to the compact column written method

	3	6
x		7
2	5	2
	4	

Following on from year 2…
Using arrays and known facts for multiplication of two single digit numbers

Children should be encouraged to move from arrays to use known multiplication facts to calculate others that are unknown to them.

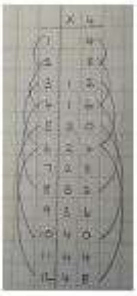
They should use a toolbox and doubling, to support their calculations.

1 x 4 = 4
2 x 4 = 8
4 x 4 = 16
8 x 4 = 32

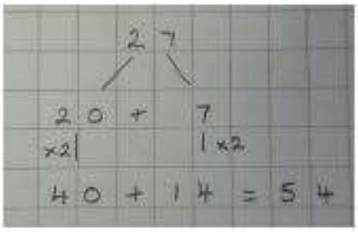
3 x 4 = 12
6 x 4 = 24
12 x 4 = 48

5 x 4 = 20
10 x 4 = 40

By the end of Year 3, children should be confident to show the doubling patterns on their toolboxes.



Doubling 2-digit numbers mentally



Doubling 2-digit numbers using partitioning mentally:

27 doubled is the same as 20 doubled, which is 40, add 7 doubled, which is 14.

40 add 14 equals 54.

Using expanded column written method for multiplying a two-digit by a single-digit number (TO x O)

Children should be encouraged to use a toolbox to support their calculations.

5 3 x 8 =

```
   5  3
x     8
   2  4  (3 x 8)
4  0  0  (50 x 8)
4  2  4
```

Model the expanded column method, paying particular attention to the value of the digits involved.

Once secure, children can move onto compact written method (using a toolbox as necessary):

```
   5  3
x     8
4  2  4
   2
```

Solving problems, including missing number problems

Remind the children that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.

Explore missing number problems using the knowledge that multiplication is the inverse of division.

3 x 4 = 4 x 3 3 x 4 = 12 (12 ÷ 4 = 3)

__ x 8 = 16 (16 ÷ 8 = __) 3 x __ = 12 (12 ÷ 3 = __)

20 x 8 = 160 __ x 20 = 160 (160 ÷ 20 = __) 160 ÷ __ = 8 (160 ÷ 8 = __)

National Curriculum Programme of Study:

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Y3

Division

BY THE END OF YEAR 3…

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

$$\begin{array}{r|ll} & 2 & 1 \\ \hline 3 & 6 & 3 \end{array}$$

Compact written method for division, with no requirement to exchange tens for ones

$$\begin{array}{r|lll} & 2 & 1 & r2 \\ \hline 3 & 6 & 5 & \end{array}$$

Following on from year 2…
Using place value counters to model division with arrays

Initially use calculations with small numbers that will give whole number answers without remainders, e.g. 15 ÷ 3. Discuss the concept of the place value counters, that one '10' counter is worth ten '1' counters (point out the similarity to coin values).

Represent 15 in as few counters as possible and ask the children to discuss how they could divide it by 3. Refer to model used in Year 2, with base ten equipment.

(1)

(2)

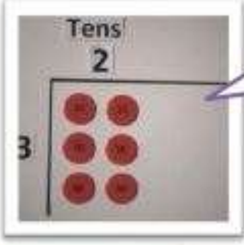
If not suggested, then model how the '10' counter needs to be exchanged for ten '1' counters. This can then be 'grouped' into threes (1), or 'shared' between 3 (2). Emphasise that an array can provide an image for division as well as multiplication and discuss related facts.

Adding the boundary line moves children towards the formal written representation for short division. Children might discuss how they *shared* the counters between the three rows.
The 3 rows and 5 columns denote the numerals at both the left hand side and the top of the image.

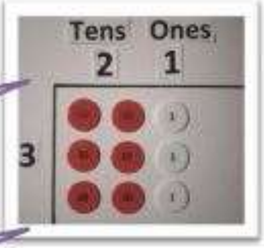
Extending to division of larger numbers using place value counters

Once calculations involve larger numbers, it is not appropriate or efficient to divide using separate '1' counters. Provide examples where the dividend can be divided exactly by the divisor, leaving no remainder. E.g. 63 ÷ 3

As above, add the boundary line and start to share the counters between the three rows.
Start with the '10' counters, then move on to the '1' counters



Six 10 counters shared between 3 people would give them 2 ten counters each, which equals 20



Three '1' counters shared between 3 people would give them one '1' counter each.

Altogether they would have 21 each. 63 divided by 3 is 21. One third of 63 is 21.

$$\begin{array}{r|l} & 2\ \ 1 \\ \hline 3 & 6\ \ 3 \end{array}$$

The written method for short division should be introduced alongside the place value counters, discussing similarities in layout.

Modeling remainders

When children are secure with the use of place value counters for modelling divison, and can understand the link with the formal short division method, examples should be provided where whole number remainders will occur.

E.g. 87 ÷ 4
The eight 'ten' counters have been 'shared' between the 4 rows, with each row receiving two 'ten' counters, or 20.
The seven '1' counters are then shared between the four rows. Each row receives one '1' counter, and there are 3 remaining.
The formal written layout should be carried out alongside.

$$\begin{array}{r|l} & 2\ \ 1\ \ r.3 \\ \hline 4 & 8\ \ 7 \end{array}$$

Solving problems including missing number problems

Remind the children that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
Explore missing number problems using the knowledge that multiplication is the inverse of division.