Salcombe C of E
Primary School

Helping your child with Maths Calculations

SALCOMBE PRIMARY PARENTS BOOKLET

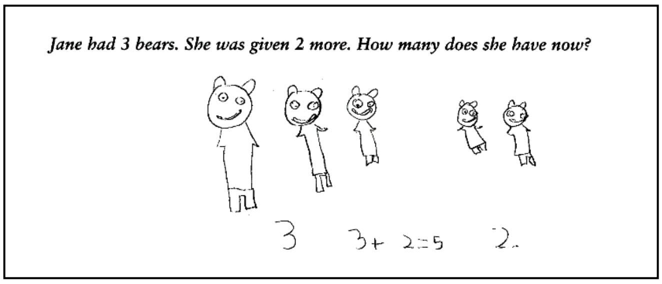
This booklet aims to show you, as simply as possible, how you can help your children. Methods of calculation have changed greatly in the past ten years.
When children are in years 1 and 2 they are **not** expected to record vertical calculations in this way

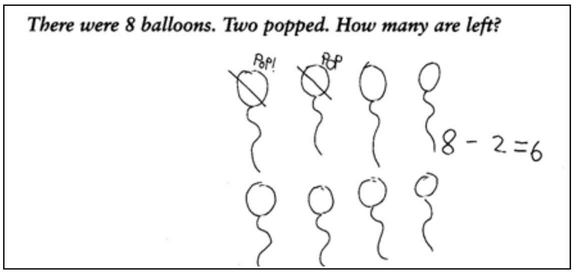
$$\begin{array}{r} 6 \\ 4 \; + \\ \hline 10 \\ \hline \end{array} \qquad \begin{array}{r} 1\,{}^{1}7 \\ - \;\; 9 \\ \hline 8 \\ \hline \end{array}$$

but this doesn't mean that they won't learn that 6 + 4 = 10 or 17 – 9 = 8 as number facts.

Throughout this booklet we have tried to show how skills can be developed from early mental calculations to formal written recording.

Children will be doing a daily mixture of counting, talking about numbers and using numbers to solve real life problems. They will begin to record what they've done with pictures and numbers. These recordings will help them to understand what is happening and to show how they've worked something out. Here are two examples of early recording.





Throughout Key Stage 2 children will continue to use horizontal recording of addition and subtraction to support their mental calculations. They will also continue to use drawings, diagrams and blank number lines to support their thinking.

The maths work your child is doing at school may look very different to the kind of 'sums' you remember. This is because children are encouraged to work mentally, where possible, using personal jottings to help support their thinking. Even when children are taught more compact written methods, they are only encouraged to use these methods for calculations they cannot solve in their heads. The more compact written methods may also look different to the way in which you were taught.

This booklet shows the range of different methods that we are now teaching.

INTRODUCTION

The national curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of maths. This means that they develop a good understanding of our number system. They need to know key number facts and be able to recall them rapidly so that they can use this knowledge rapidly and accurately.
- **reason mathematically** and explain their thinking using mathematical language as they work on different areas of maths. They need to be able to ask mathematical questions and work out ways to answer them. Children also need to be able to look for patterns and use them to make predictions or generalisations. Being able to justify their ideas is a vital skill.
- can **solve problems** by applying their understanding of maths to different types of problems so that they are able to break them down into a series of simpler steps. When children find a problem challenging they are encouraged to persevere and keep trying different ideas as they seek a solution. Understanding is the key.

THE RULES

- Whatever method children use they should be confident to use it with real understanding, rather than just following a set of rules or a set method, where they are more likely to make mistakes. (Many adults were taught like this and consequently never understood what they were doing.)
- Children must understand how a method works if they are going to use it accurately, reliably and efficiently.
- Moving children on too quickly to a new approach can lead to confusion.

We build up a TOOLKIT of skills in the following order:

Mental recall

Counting skills

Mental calculation

Jottings

Counting skills

Formal methods of calculation

COUNTING SKILLS

In addition to recognising numbers, counting is one of the first skills that children learn. This begins before they come to school. They also need to be able to apply this to the counting of physical objects.

Counting and understanding the value of digits underpins a lot of maths and becomes increasingly important as the maths gets harder.

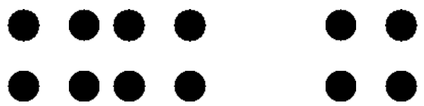
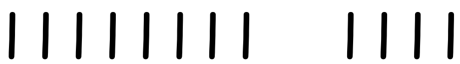
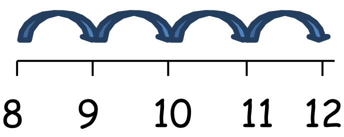
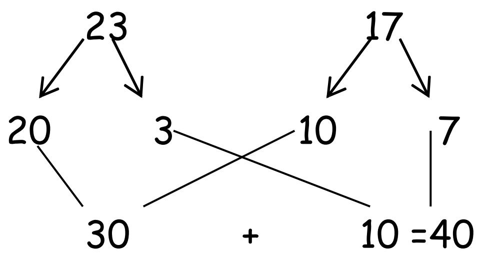
Below is a rough progression for counting
Count up to 5
Count up to 10
Count up and back from 10
Count up/back from 20
Count up/back from 50
Count up/back from 100
Develop onto bigger numbers and beyond zero

It is also important to develop the ability to count in steps of different sizes.
The most common versions of this are the multiplication tables
2x, 10x, 5x
3x, 4x
6x,11x,
7x,8x,9x, 12x
Beyond this the children are encouraged to relate what they know from tables to other counting and /or division.
For example
If you can count in 6s this means, you can count in 60s, 600s and even 0.6s
If you know 3x4=12 you also know 4x3=12,   12÷3=4 12÷4=3
Using place value we also know:
0.4 x 3 =1.2   0.4 x 0.3 = 0.12
40 x 3 =120   40 x 30 = 1200
400 x 30 = 12,000

WRITTEN ADDITION

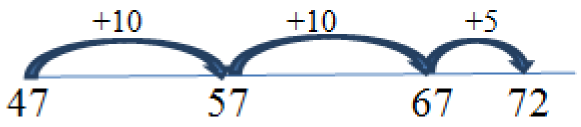
Knowledge needed to be able to start this:
Mental counting skill (up to 10 at least.)
Understanding of the language: more, added on, increase

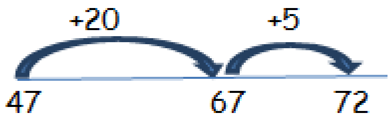
Children are taught to understand addition as combining two sets and counting on.

2 + 3 = $\square$ At a party, I eat 2 cakes and my friend eats 3 cakes. How many cakes did we eat altogether? 	Children can use physical objects or draw a picture to help them work out the answers.
8 + 4 = $\square$ 8 people are on a bus. 4 more get on at the next stop. How many people are on the bus now?  or 	Children use dots or tally marks to represent the objects as this is quicker than drawing pictures. They are encouraged to hold the larger number in their head and count on using a number line. 
23 + 17 = $\square$ I had 23 photos in my camera. Next time I took 17 more. How many photos altogether? 	Children split up the number into its separate values (tens and units or ones) and then they add each part before finding the final total. This is called PARTITIONING.

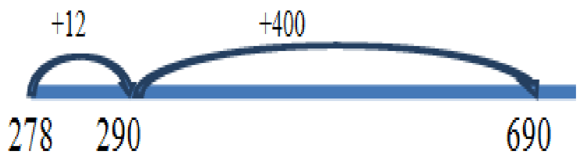
47 + 25 = $\square$

My sunflower is 47cm tall. It grows another 25cm. How tall is it now?





278 + 412 =



Drawing an empty number line helps children to record the steps they have taken in the calculation.

Start on 47 + 10 +10 then + 5.

Move to 47 +20 then +5

This is much more efficient than counting in ones.

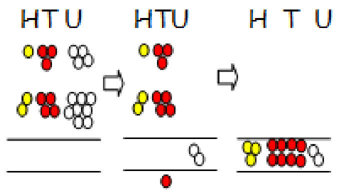
Children may still be using the number line to solve a mental calculation involving larger numbers

134 + 248 = 382

There are 134 boys and 248 girls in a school. How many children are there altogether?

Children move on to adding numbers with up to three digits, using formal written methods of column addition. They will use apparatus to help them see how it works.

134 + 248 = 382




```
  HTU
  134
+ 248
  ---
  382
   1
```

The use of apparatus alongside the written method is imperative to ensure conceptual understanding

12,786 + 2,568 =

12 786 people visited the museum last year. The numbers increased by 2,568 this year.

How many people visited altogether this year?

```
  12 ,786
+  2 ,568
  -------
  15 ,354
  1    11
```

Once children are confident at using this formal method they build on this to work with larger and smaller numbers-

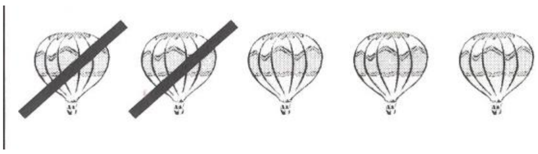
up to 10 million and decimals with up to 3 decimal places by Year 6

WRITTEN SUBTRACTION

Knowledge needed to be able to start this:
Counting backwards.
Understanding of the language: one less, less than, smaller, decrease.
Children are taught to understand subtraction as taking away (counting back) and finding the difference (counting up/on).

TAKING AWAY

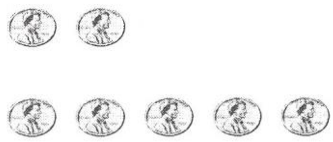
I have five balloons. Two burst. How many did I have left?



Children use physical objects or draw a picture to help them visualise

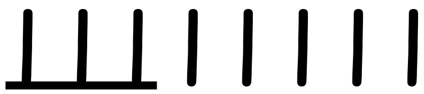
FINDING THE DIFFERENCE

A teddy costs £5 and a doll costs £2. How much more does the bear cost?



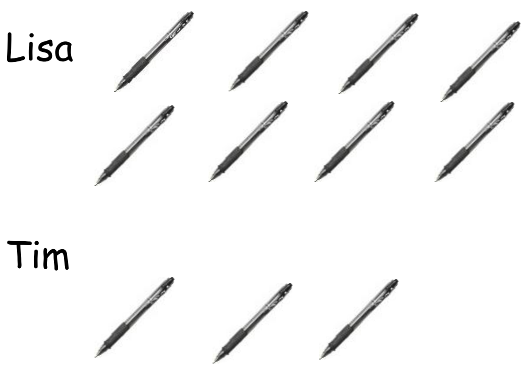
This is about comparing two groups rather than taking something away from one group

8 - 3 = $\boxed{}$
Mum baked 8 biscuits. I ate 3. How many were left?



Children use dots or tally marks to represent the objects which is quicker than drawing.

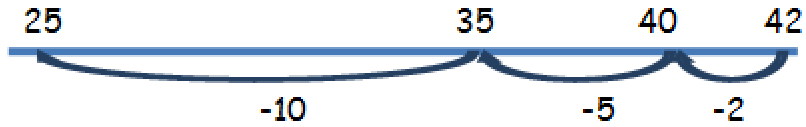
Lisa has 8 felt tip pens and Tim has 3. How many more does Lisa have?



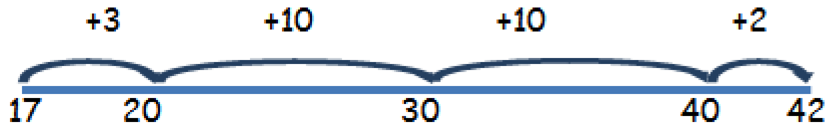
WRITTEN SUBTRACTION

Moving to 42 - 17

Taking away:



Finding the difference:

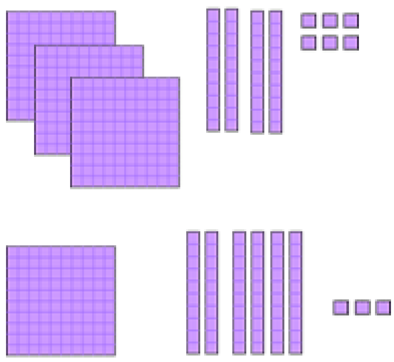


Children continue to use concrete objects, apparatus and pictorial representations to solve subtraction problems. They start to see subtraction as 'how many more'

Children use multiples of 2 and 5 to make it easier and more efficient than jumping in ones. They count back to the next 10 e.g. 42 – 2 to get to 40 or count up to next 10 e.g. 17 +3 to get to 20.

Children start to use the formal, column written method. They must begin by modelling the value and layout practically, using labelled columns. The strategy and method must be secure before moving onto exchanging

They do each column with Diennes or place value counters and record the calculation alongside.



	H	T	U
	$^{2}\cancel{3}$	$^{1}4$	6
-	1	6	3
	1	8	3

£ 7,432 - £2,518 =

A car costs £7432. A deposit of

£2,518 has to be paid. How much more needs to be paid?

When children are confident with

borrowing they will move to the

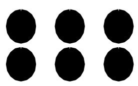
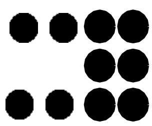
compact method or decomposition method of subtraction, working with larger and smaller numbers including to 10 million and decimals to 3 decimal places.

7432 - 2518 = 4914

	Th	H	T	U
	$^{6}\cancel{7}$	$^{1}4$	$^{2}\cancel{3}$	$^{1}2$
-	2	5	1	8
	4	9	1	4

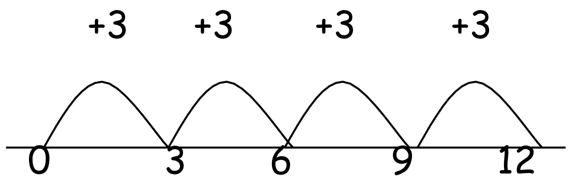
WRITTEN MULTIPLICATION

Knowledge needed to be able to start this:
Mental counting skills in steps/multiplication tables e.g. 2s, 10s
Understanding of the language: lots of, sets of, array, groups
Children are taught to understand multiplication as repeated addition. It can also be used to describe an array.
As soon as possible it is important to make links to division facts.

2 x 4 = $\square$ Each gingerbread man has two eyes. How many eyes do four gingerbread men have?  2 + 2 + 2 + 2	Children use physical objects or draw a picture to help them work out the answer. The language of lots of may be introduced.
5 x 3 = $\square$ There are 5 cakes in a pack. How many cakes in 3 packs?  5 + 5 + 5	Dots or tally marks are often drawn in groups. This shows 3 lots of 5.
4 x 3 = $\square$ A chew costs 4p. How much do 3 chews cost?  or  These pictures are called arrays	Drawing an array ~ 3 rows of 4 or 4 rows of 3 gives children an image of the answer. It also helps develop the understanding that 4x3 is the same as 3x4. Once children are ready, links can be made e.g. 4 groups of 3 =12 so 12 ÷ 3 groups =4.

3 x 4 = $\square$

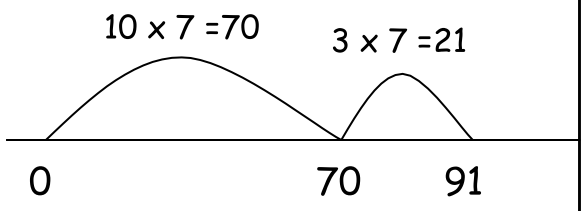
There are 4 cats. Each cat has three kittens. How many kittens are there altogether?



Children learn to count on in equal steps, recording each jump on an empty number line. This shows 4 jumps of 3

13 x 7 = $\square$

There are 13 biscuits in a packet. How many biscuits in 7 packets?



When numbers get bigger it is inefficient to do lots of small jumps so children are encouraged to split 13 into parts (10 and 3). This gives you two jumps 10 x 7 and 3 x 7

6 x 124 = $\square$

124 books were sold. Each book costs £6. How much money was taken?

X	100	20	4	
6	600	120	24	= 744

This is called the grid method. 124 is split into parts (100, 20 and 4) and each of these is multiplied by 6. The three answers are then added together. Calculations then move into this method for ones such 72 x 34.

72 x 34 =

If a tin of beans costs 34p. How much will 72 tins cost? When children are confident using the grid method, they move to use vertical formal methods. Eventually working with larger numbers and decimals

X	70	2
30	2100	60
4	280	8

```
  2160
+  288
  2448
   1
```

→

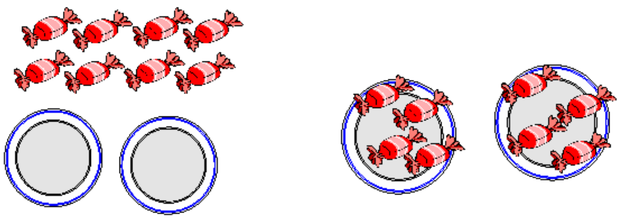
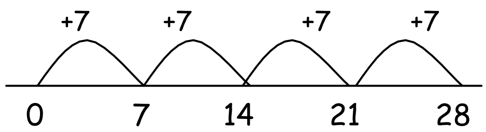
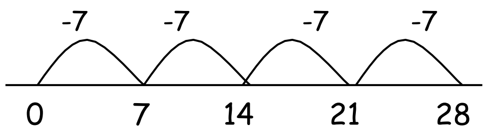
```
       7 2
    x  3 4
         8 (4 x 2)
     2 8 0 (4 x 70)
       6 0 (30 x 2)
   2 1 0 0 (30 x 70)
   2 4 4 8
```

→

	Th	H	T	U	
			7	2	
x			3	4	
		2	8	8	(72 x 4)
	2	1	6	0	(72 x 30)
	2	4	4	8	
		1			

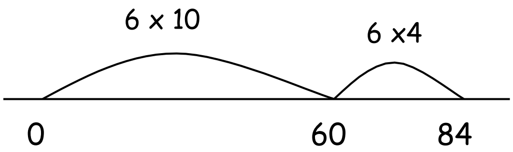
WRITTEN DIVISION

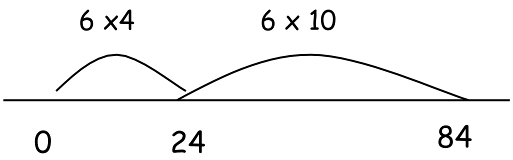
Knowledge needed to be able to start this:
Mental counting skills in steps / multiplication tables e.g. 2s, 10s
Understanding of the language: lots of, grouping, sharing
Children are taught to understand division in two ways:
sharing and grouping.
Many children can often confuse the two ideas.
It is important that children are taught both pictures of division.

8 ÷ 2 = ☐ Can we share these eight sweets between two friends? 	Although division is not formally introduced in the foundation stage the ground work is done here. They share objects into equal groups and count how many in each group, Drawing often gives children a way into a problem.
12 ÷ 4 = ☐ 12 apples are shared equally between four children. How many apples are will they have each? ||| ||| ||| ||| 12 apples are put in bags. There must be 3 in each bag. How many bags will there be? [|||] [|||] [|||] [|||]	Children use dots or tally marks In the first example the tally marks are shared out one by one. In the second example the tally marks are placed into boxes that represent bags in groups of three.
28 ÷ 7 = ☐ A chew bar costs 7p. How many can I buy with 28p?  	To work out how many 7s there are in 28, draw jumps of 7 along a number line. This shows you need 4 jumps of 7 to reach 28. This can also be viewed as how many chunks of 7 can you remove from 28.

84 ÷ 6 = $\square$

I need 6 drawing pins to put up a picture. How many pictures can I put up with 84 pins?

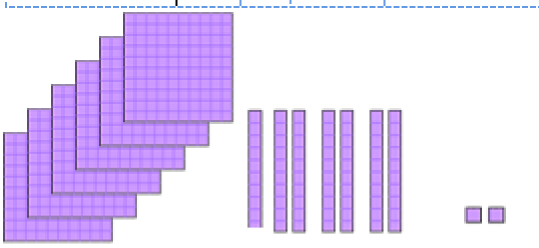




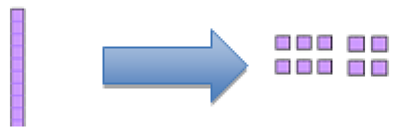
It would take a long time to jump in sixes to 84 so children can jump on in bigger 'chunks.'
A jump of 10 lots of 6 takes you to 60. Then you need another 4 lots of 6 to reach 84. Altogether, that is 14 sixes.
This can also be viewed as how many chunks of 6 can you remove from 84.

672 ÷ 3 = $\square$
672 marbles are shared between three friends How many marbles will each child have?

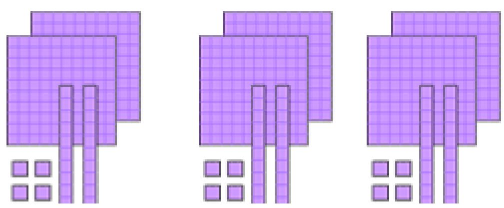
	2	2	4
3	6	7	$^{1}2$



6 hundred 7 tens 2 ones



Exchange 1 ten into 10 ones



Children now practice to become fluent in the formal written method of short division for a three-digit number by a one-digit number with exact answers.

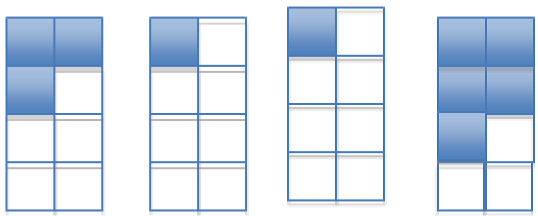
This method is sometimes called the compact or 'bus stop' method.
As with all written calculations, it is introduced using Diennes or place value counters alongside the calculation to aid their understanding.

They make 672 using Diennes or counters. "Start with 6 hundreds. How many groups of 3 hundreds can I make with these 6 hundred blocks? 2 groups of 3 hundreds. Record above hundreds. How many groups of 3 tens can I make with 7 ten rods? 2 groups of 3 tens with 1 left over. Record the 2 above the tens then exchange the remaining ten into 10 ones. Add these to the 2 ones to make 12 ones altogether. Record this in the ones column. How many groups of 3 ones can I make with 12 ones? 4. Record this above the ones column. So 672 ÷3 = 224

Once children are confident at using this method, they move on to work with numbers that result in remainders, learning to show these as remainders, fractions and decimals.

CALCULATING WITH FRACTIONS

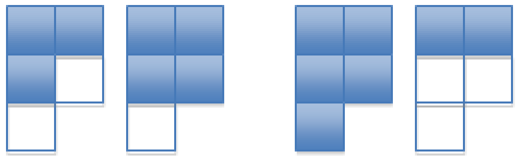
$^{3}/_{8} \; + \; ^{1}/_{8} \; + \; ^{1}/_{8} \; = \; ^{5}/_{8}$



In Year 3 children begin to add fractions with the same denominator up to a whole. They need to experience doing this with practical apparatus and images to reinforce their understanding.

They also begin to recognise fractions that add to make one whole e.g $\frac{1}{4} + \frac{3}{4}$ or $^{3}/_{5} + {}^{2}/_{5}$

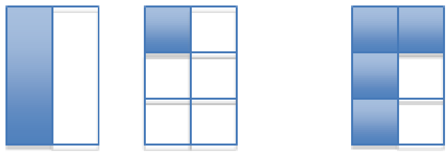
$^{3}/_{5} \; + \; ^{4}/_{5} \; = \; ^{7}/_{5} \; = \; 1\,^{2}/_{5}$



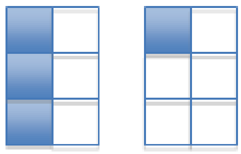
$^{2}/_{3} \; + \; ? \; = \; 1$

Children in Year 4 then move to adding fractions with the same denominator beyond one whole. Again, this is done practically and pictorially.

$^{1}/_{2} \; + \; ^{1}/_{6} \; = \; ^{4}/_{6}$



$= \; ^{3}/_{6} \; + \; ^{1}/_{6}$



In Year 5 they see the relationship between the two fractions, realising that to convert $^{1}/_{2}$ s into $^{1}/_{6}$ s you multiply by 3 and whatever you do to the denominator you must do to the numerator so you multiply that by 3 also:

$$^{1}/_{2} \underset{\times 3}{\overset{\times 3}{=}} {}^{3}/_{6}$$

$2\,^{1}/_{6} + 1\,^{2}/_{3} =$

$$^{1}/_{6} \underset{\times 2}{\overset{\times 2}{=}} {}^{2}/_{12} \qquad ^{2}/_{3} \underset{\times 4}{\overset{\times 4}{=}} {}^{8}/_{12}$$

$2\,^{2}/_{12} + 1\,^{8}/_{12} = 3\,^{10}/_{12}$

$= \underline{3\,^{5}/_{6}}$

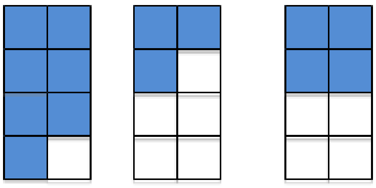
Children in Year 6 now move on to adding mixed numbers and fractions with different denominators, using the concept of equivalent fractions. They start with fractions with denominators that are a multiple of each other and progress onto more complex problems, e.g. converting to a common denominator.

Here children recognise that both 6 and 3 are factors of 12 so they convert the fractions to 12^{ths} to continue the calculation. They give their answer in the simplest form, recognising that $^{10}/_{12}$ can be divided by 2 and therefore simplified to $^{5}/_{6}$.

CALCULATING WITH FRACTIONS

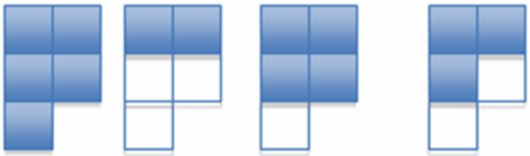
Subtraction

$^{7}/_{8} \; - \; ^{3}/_{8} \; = \; ^{4}/_{8}$



In Year 3 children begin to subtract fractions with the same denominator, within one whole. They use practical apparatus and pictorial representations to explore this.

$1\,^{2}/_{5} \; - \; ^{4}/_{5} \; = \; ^{3}/_{5}$

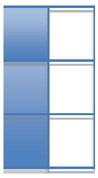


or $^{7}/_{5} \; - \; ^{4}/_{5} \; = \; ^{3}/_{5}$

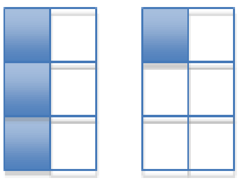
$1 - ^{2}/_{3} = ^{1}/_{3}$

Children in Year 4 then move to subtracting fractions with the same denominator beyond one whole. Again this is done practically and pictorially.
Children realise that one whole in this example is $^{5}/_{5}$ and therefore $1\,^{2}/_{5}$ gives you $^{7}/_{5}$ altogether.
Use fractions that add to 1 to find fraction complements to 1.

$^{1}/_{2} \; - \; ^{1}/_{6}$



$= \; ^{3}/_{6} \; - \; ^{1}/_{6}$



$\overset{\times 3}{\underset{\times 3}{^{1}/_{2} \; = \; ^{3}/_{6}}}$

Children extend this to work with fractions with denominators that are multiples of the same number in Year 5. They see the relationship between the two fractions, realising that to convert $^{1}/_{2}$ s into $^{1}/_{6}$ s you multiply by 3 and whatever you do to the denominator you must do to the numerator so you multiply that by 3 also:

$\overset{\times 3}{\underset{\times 3}{^{1}/_{2} \; = \; ^{3}/_{6}}}$

$5^{2}/_{3} - 3^{2}/_{5} =$

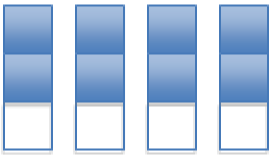
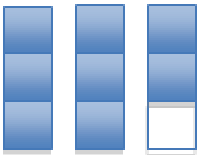
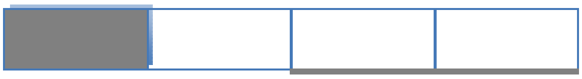
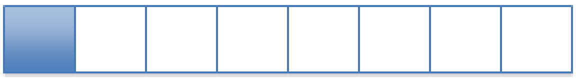
$\overset{\times 5}{\underset{\times 5}{^{2}/_{3} \; = \; ^{10}/_{15}}}$ $\qquad$ $\overset{\times 3}{\underset{\times 3}{^{2}/_{5} \; = \; ^{6}/_{15}}}$

$5\,^{10}/_{15} \; - \; 3\,^{6}/_{15} \; = \; 2\,^{4}/_{15}$

In Year 6 working with fractions is then extended to subtracting mixed numbers and fractions with different denominators. Here children recognise that both 3 and 5 are factors of 15 so they convert the fractions to 15^{ths} to continue the calculation.

CALCULATING WITH FRACTIONS

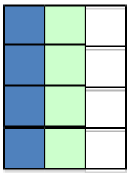
Multiplication

$4 \times {}^{2}/_{3} =$  $= {}^{8}/_{3}$  $= 2^{2}/_{3}$	Children in Year 4 begin to multiply fractions and mixed numbers by whole numbers ≤ 10. The use of apparatus and images to support this is vital. They see the image of ${}^{2}/_{3}$ and they draw this 4 times. They still are counting in thirds but there are 4 groups of them. Therefore ${}^{8}/_{3}$. They use their knowledge of how many thirds make a whole to convert this to $2^{2}/_{3}$
$36 \times {}^{1}/_{4} =$ $36 \div 4 = 9$	Children are encouraged to connect multiplication by a fraction to using fractions as operators (fractions of). In this example this means $\frac{1}{4}$ of 36.
${}^{1}/_{4} \times {}^{1}/_{2} = {}^{1}/_{8}$  ${}^{1}/_{4}$ of a whole  ${}^{1}/_{2}$ of a quarter  	In Year 5 children continue their work in on multiplying fractions and mixed numbers by whole numbers. This is extended to multiply simple pairs of proper fractions. We use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of). e.g. In this example they draw a quarter and then realize they have to find ${}^{1}/_{2}$ of that quarter. They can see from the diagram that if they ${}^{1}/_{2}$ a ${}^{1}/_{4}$ this would fit into the whole 8 times and therefore ${}^{1}/_{2}$ of a ${}^{1}/_{4}$ must be ${}^{1}/_{8}$.
$\frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1}{4 \times 2} = \frac{1}{8}$	By Year 6 children will see that without practical apparatus they will see that to multiply You have to multiply the numerators (top numbers) and then multiply the denominators (bottom numbers).Finally, if it is appropriate, the fraction should be simplified.

CALCULATING WITH FRACTIONS

Unit fractions: 1/5 of 10 = 2

Non-unit fractions: 2/3 of 12 = 8

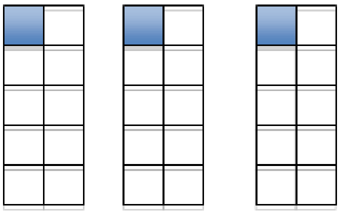


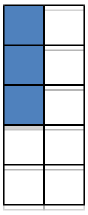
1/3 shown in dark grey
2/3 is dark grey and light grey

In Year 3 children find unit fractions of quantities and begin to find non-unit fractions of quantities.

They start to see the relationship between the denominator being the number of equal parts (and therefore the divisor e.g. 3) and the numerator being how many of those equal parts (the multiplier e.g. 2).

Correspondence problem: 3 cakes shared equally among 10 children.



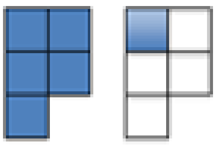


= 3/10 of cake per child.
= 0.3 of a cake

In Year 4 pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This includes correspondence questions.
Children work practically and visually so they see the need to split each cake into 10 equal parts. Each child then gets 1/10 of each cake and therefore 3/10 altogether .

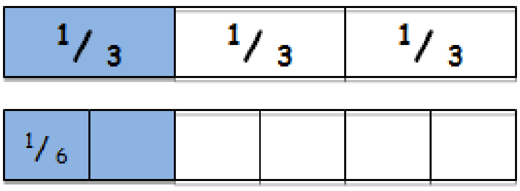
$^{6}/_{5} = 1\,^{1}/_{5}$

6÷5 = 1 r 1 so the remainder is $^{1}/_{5}$ because you are dividing by 5
or they see that $^{5}/_{5}$ makes one whole with $^{1}/_{5}$ left over.



In Year 5 children continue to find non-unit fractions of large amounts and turn improper fractions into mixed numbers and vice versa .

$^{1}/_{3} \div 2 = {}^{1}/_{6}$



$$\frac{1}{3 \times 2} = \frac{1}{6}$$

In Year 6 children divide proper fractions by whole numbers. They understand that you need to divide 1/3 into 2 equal parts. They might use a fraction wall to help. If I split a third into 2 equal parts, how many parts will there be in the whole? 6. So $^{1}/_{3} \div 2 = {}^{1}/_{6}$
The way to do this without pictures is displayed below.