Fleet Primary School
Calculation Policy

Our aims are to ensure consistency and progression in maths teaching, and enjoyment and achievement in maths learning throughout the whole school.

How will we help children to develop their understanding of calculation?

Children are introduced to the processes of calculation through practical, visual, oral and mental activities. As children begin to understand the underlying ideas they develop ways of visualising and recording to support their thinking and calculation methods. They learn to interpret and use the signs and symbols involved, choosing when to use which methods.

Over time children learn how to use models and images, such as empty number lines, to support their mental and informal written methods of calculation. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally.

By the end of Year 6 children are equipped with mental, written and calculator methods that they understand and can use correctly. When faced with a calculation, children are able to decide which method is most appropriate and have strategies to check its accuracy. At whatever stage in their learning, and whatever method is being used, it must still be underpinned by a secure and appropriate knowledge of number facts, along with those mental skills that are needed to carry out the process and judge if it was successful.

It is important to remember that written methods do not replace mental methods of calculation.

How to achieve consistency

It is imperative that...

- There is a consistent set of images and models which are developed throughout the children's primary years eg.

beaded number line ------ marked number line ------- empty number line

- The vocabulary used to describe methods should be agreed by each teacher so the words used are the same from one year to the next to avoid confusion.

- There is agreement as to the development of written methods of calculation, to avoid abrupt (and to the children, unexplained) changes in which are taught.

When children leave Fleet Primary they should:

- have a secure knowledge of number facts and a good understanding of the four operations;

- be able to use this knowledge and understanding to estimate their answer and carry out **mental** calculations involving one-digit and two-digit numbers;

- make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;

- have an efficient, reliable, compact **written** method of calculation for each operation that they can apply with confidence when undertaking calculations that they cannot carry out mentally;

Mental methods of calculation

Oral and mental work in mathematics is essential, particularly so in calculation. Early practical, oral and mental work must lay the foundations by providing children with a good understanding of how the four operations build on efficient counting strategies and a secure knowledge of place value and number facts. Later work must ensure that children recognise how the operations relate to one another. The ability to calculate mentally forms the basis of all methods of calculation and has to be maintained and refined. A good knowledge of numbers or a 'feel' for numbers is the product of structured practice and repetition. It requires an understanding of number patterns and relationships developed through directed enquiry, use of models and images and the application of acquired number knowledge and skills.

Secure mental calculation requires the ability to:

- recall key number facts instantly;
- use taught strategies to work out the calculation;
- understand how the rules and laws of arithmetic are used and applied.

Expectations for Number facts

Year 1

- Represent and use number bonds and related subtraction facts within 20
- Add and subtract one-digit and two-digit numbers to 20, including 0
- Count on or back in ones, twos, fives and tens and use this knowledge to **derive the multiples of 2, 5 and 10** to the tenth multiple
- Recall the doubles of all numbers to at least 10

Year 2

- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- Understand that halving is the inverse of doubling and derive and recall doubles of all numbers to 20, and the corresponding halves
- Show that addition of 2 numbers can be done in any order (commutative) and subtraction of 1 number from another cannot
- Derive and recall **multiplication facts for the 2, 5 and 10 times-tables** and the related division facts; recognise multiples of 2, 5 and 10

Year 3

- Derive and recall all addition and subtraction facts for each number to 20, sums and differences of multiples of 10 and number pairs that total 100
- Add and subtract numbers with up to 3 digits, using formal written methods of columnar addition and subtraction
- Derive and recall **multiplication facts for the 2, 3, 4, 5, 8 and 10 times-tables** and the corresponding division facts; recognise multiples of 2, 5 or 10 up to 1000

Year 4

- Use knowledge of addition and subtraction facts and place value to derive sums and differences of pairs of multiples of 10, 100 or 1000
- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- Identify the doubles of two-digit numbers; use these to calculate doubles of multiples of 10 and 100 and derive the corresponding halves
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together 3 numbers
- **Derive and recall multiplication facts up to 12 × 12**, the corresponding division facts and multiples of numbers to 10 up to the tenth multiple
- Identify pairs of fractions that total 1

Year 5

- Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34)
- **Recall quickly multiplication facts up to 12 × 12** and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts.
- Multiply numbers up to 4 digits by a 1- or 2- digit number using a formal written method, including long multiplication for 2-digit numbers
- Divide numbers up[to 4 digits by a 1-digit number using the formal written method of short division and interpret remainders appropriately for the context
- Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9)
- Establish whether a number up to 100 is prime and recall prime numbers up to 19
- Recognise and use square numbers and cube numbers, and the notations for squared and cubed

Year 6

- Use knowledge of place value and **multiplication facts** to 12 × 12 to derive related multiplication and division facts **involving decimals** (e.g. 0.8 × 7, 4.8 ÷ 6)
- Use knowledge of multiplication facts to derive quickly **squares of numbers** to 12 × 12 and the corresponding squares of multiples of 10
- Recognise that prime numbers have only two factors and identify prime numbers less than 100; find the prime factors of two-digit numbers
- Multiply multi-digit numbers up to 4 digits by a 2-digit whole number using the formal written method of long multiplication
- Divide numbers up to 4 digits by a 2-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Application of number bonds – calculate don't count. (22+7 = 20 + (2+7))

Strategies for teaching number facts:

- Speed tests *Speed tests are carried out weekly (Fleet Facts) done in this order and repeated regularly:*
- *2, 10, 5, 4, 3, 6, 9, 8 and 7*
- Roll the die & multiply
- Times table/ number bond tournament (all children on the list going one on one to move up or down the league table each day)
- Clap and chant
- Ping pong
- Using a 100 square or counting stick to rehearse and order multiples
- Factor bugs (finding factors of a number drawn as legs on a bug)
- Number properties guessing games
- Snap games

Fundamental to all these calculations --------Place Value (cycle):

All about positioning – number lines, counters, dienes

Number tracks
Landmarked
Empty
Different orientation

Written methods of calculation

The aim is that by the end of Key Stage 2, the great majority of children should be able to use an efficient written method for each operation with confidence and understanding. Being able to use these written methods gives children an efficient set of tools they can use when they are unable to carry out the calculation in their heads or do not have access to a calculator. We want children to know that they have such a reliable, written method to which they can turn when the need arises.

Progression through Calculations

Up to Year 3, the emphasis should be on children working mentally. Once written methods are introduced, mental skills must be kept sharp by continuing to develop and apply them with appropriate examples.

When do children need to start recording?
It is important to encourage children to look first at the problem and then get them to decide on the most efficient method to use – pictures, mental calculation with or without jottings, or structured recording.

<table>
<tr><td>Reception</td><td>Year 1</td><td>Year 2</td><td>Year 3</td><td>Year 4</td><td>Year 5</td><td>Year 6</td></tr>
<tr><td colspan="7">Making a record of a calculation →</td></tr>
<tr><td colspan="2"></td><td colspan="5">Jotting to support a new mental strategy
(but ditching jotting when secure in that strategy) →</td></tr>
<tr><td colspan="3"></td><td colspan="4">Explaining a mental strategy →</td></tr>
<tr><td colspan="4"></td><td colspan="3">Developing written methods →</td></tr>
</table>

What about children at different stages of attainment?
In many classes, children will be at different stages in their move towards efficiency. This process should not be rushed; children should be moved on when they are ready. That is why it is so crucial for us to be familiar with all stages of calculation.

How can children's readiness for written calculations be judged?
Judgements will need to be made as to whether pupils possess sufficient of these skills to progress. Different prerequisite skills are needed for each operation.

A short list of criteria for readiness for written methods of addition and subtraction would include:

- Do children know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers into hundreds, tens and ones?
- Do they use and apply the commutative and associative laws of addition?
- Can they add at least three 1-digit numbers mentally?
- Can they add and subtract any pair of 2-digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?

A short list of criteria for readiness for written methods for multiplication and division are:

- Do the children know the 2, 3, 4, 5 and 10 times tables and corresponding division facts?
- Do they know the result of multiplying by 0 or 1?
- Do they understand place value?
- Do they understand 0 as a place holder?
- Can they multiply 2 and 3 digits mentally by 10 and 100?
- Can they use their knowledge of all the multiplication tables to approximate?
- Can they find products using multiples of 10?
- Do they use the commutative and associative laws of multiplication?
- Can they halve and double 2-digit numbers mentally?

Can they use multiplication facts to derive mentally, other multiplication facts they don't know?
Can they explain their mental strategies orally and record them using informal jottings?

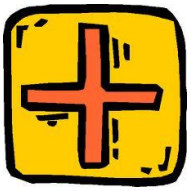
THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

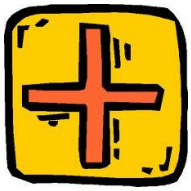
Children should be encouraged to

- **consider if a mental calculation would be appropriate before using written methods.**
- **approximate their answers before calculating.**
- **check their answers after calculation using an appropriate strategy.**

CALCULATION PROGRESSION FOR ADDITION



Sum Plus Altogether Total



Mental Calculation Strategies for Addition

These are a **selection** of mental calculation strategies which should continue to be practiced and used in lessons right up to year 6.

Mental recall of number bonds

6 + 4 = 10 ☐ + 3 = 10
25 + 75 = 100 19 + ☐ = 20

Using number bonds to add many numbers
5 + 2 + 8 + 9 + 1; combine 9 and 1, 8 and 2 to see the answer is 25

Use near doubles
6 + 7 = double 6 + 1 = 13

Addition using partitioning and recombining
34 + 45 = (30 + 40) + (4 + 5) = 79

Counting on or back in repeated steps of 1, 10, 100, 1000
86 + 57 = 143 (by counting on in tens and then in ones)
460 - 300 = 160 (by counting back in hundreds)

Add the nearest multiple of 10, 100 and 1000 and adjust

24 + 19 = 24 + 20 – 1 = 43

458 + 71 = 458 + 70 + 1 = 529

Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Addition – Written Calculation, Models & Images

Nursery & Reception

Children are taught to recognise numerals 1-10 (Nursery) 1-20 (Reception). They learn that number names are numerals.

Children count from 1-10, understanding that 0 is 'nothing', finding one more or one less than a number from 1 to 10.

They know that * * * = 3, moving or pointing to objects counted as they count. Emphasising the last number (cardinal number) to show that they count the objects and the last one is how many there are. If you move objects around, there are still 3. If you spread them out, there are still 3.

Emphasise = as a symbol of balance or equivalence or 'is the same as'. This will be the first symbol that children learn.

Follow this with using the inequality symbols to compare two quantities.

Children are able to give you a number of objects from a bigger group eg. give you 8 from a pile of 20.

They can count with help to 20, observing number relationships and patterns in the environment.

They are able to combine two groups of objects to make a given total of objects

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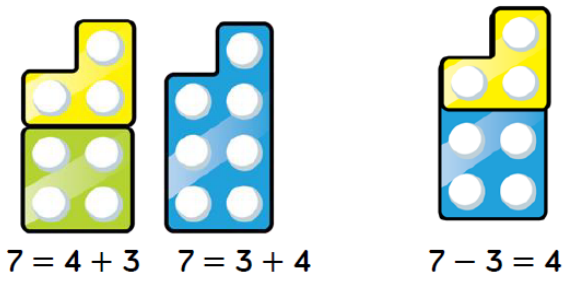
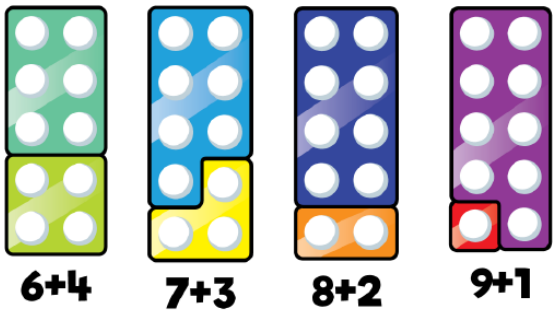
Some teaching strategies include: *using flash cards at carpet times, lining up numbers, using display to support recognition of numerals, counting incorporated into play/practical situations, using counting songs, using* ***Numicon*** *which children to visualise number, add and subtract. It is also useful for number bonds. It is not about counting, but having a mental image of a number so children know instantly what 2 or 5 looks like.*

Number Shapes





Benefits

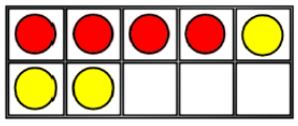
Number shapes can be useful to support children to subitise numbers as well as explore aggregation, partitioning and number bonds.

When adding numbers, children can see how the parts come together making a whole. As children use number shapes more often, they can start to subitise the total due to their familiarity with the shape of each number.

When subtracting numbers, children can start with the whole and then place one of the parts on top of the whole to see what part is missing. Again, children will start to be able to subitise the part that is missing due to their familiarity with the shapes.

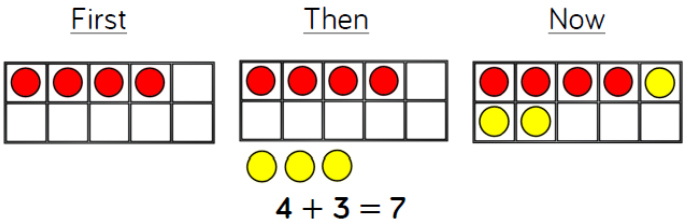
Children can also work systematically to find number bonds. As they increase one number by 1, they can see that the other number decreases by 1 to find all the possible number bonds for a number.

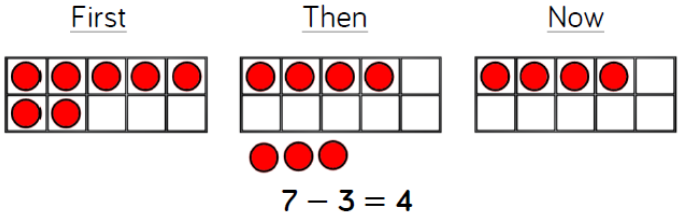
Ten Frames (within 10)



$4 + 3 = 7$
$3 + 4 = 7$
$7 - 3 = 4$
$7 - 4 = 3$

4 is a part.
3 is a part.
7 is the whole.





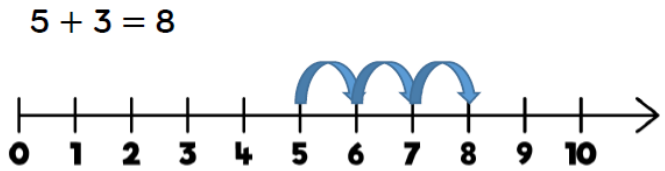
Benefits

When adding and subtracting within 10, the ten frame can support children to understand the different structures of addition and subtraction.

Using the language of parts and wholes represented by objects on the ten frame introduces children to aggregation and partitioning.
Aggregation is a form of addition where parts are combined together to make a whole. Partitioning is a form of subtraction where the whole is split into parts. Using these structures, the ten frame can enable children to find all the number bonds for a number.

Children can also use ten frames to look at augmentation (increasing a number) and take-away (decreasing a number). This can be introduced through a first, then, now structure which shows the change in the number in the 'then' stage. This can be put into a story structure to help children understand the change e.g. First, there were 7 cars. Then, 3 cars left. Now, there are 4 cars.

Number Lines (labelled)



Benefits

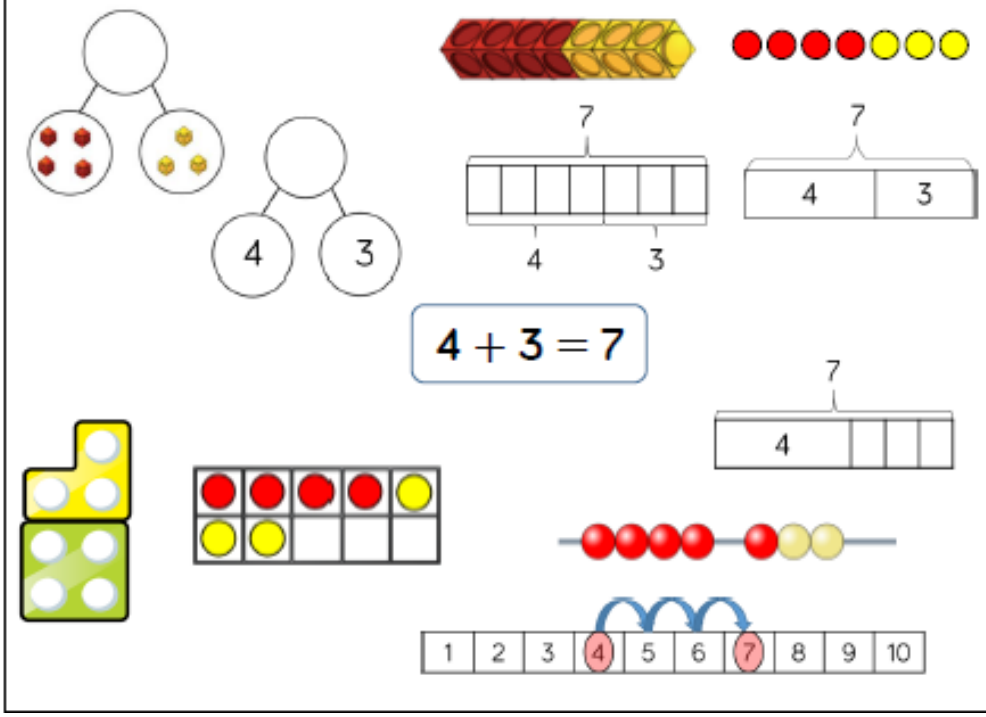
Labelled number lines support children in their understanding of addition and subtraction as augmentation and reduction.

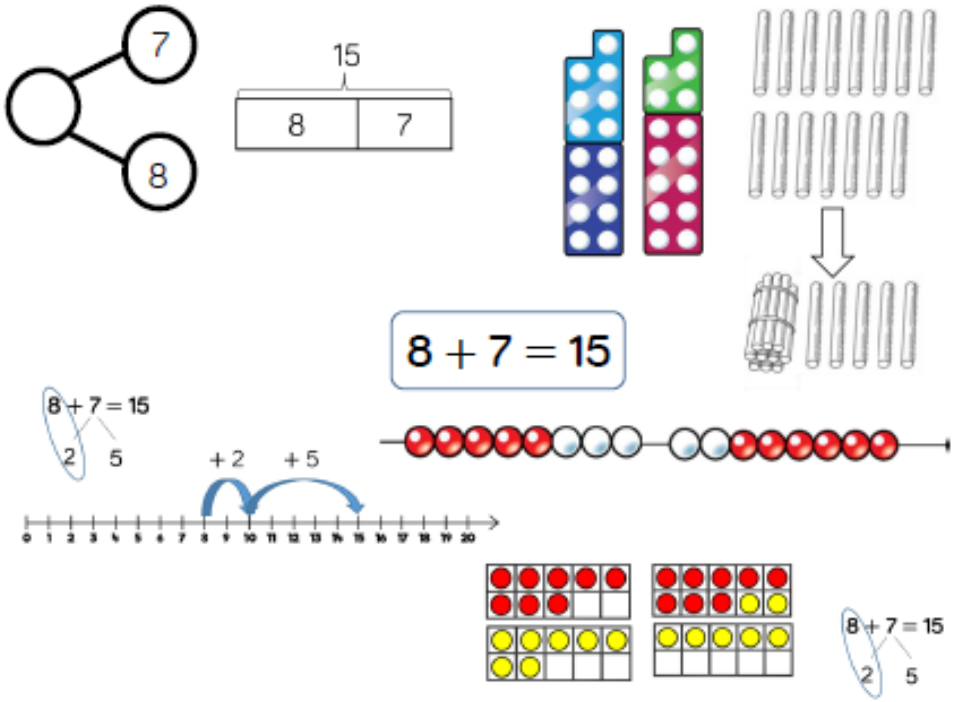
Children can start by counting on or back in ones, up or down the number line. This skill links directly to the use of the number track.

Progressing further, children can add numbers by jumping to the nearest 10 and then jumping to the total. This links to the making 10 method which can also be supported by ten frames. The smaller number is partitioned to support children to make a number bond to 10 and to then add on the remaining part.

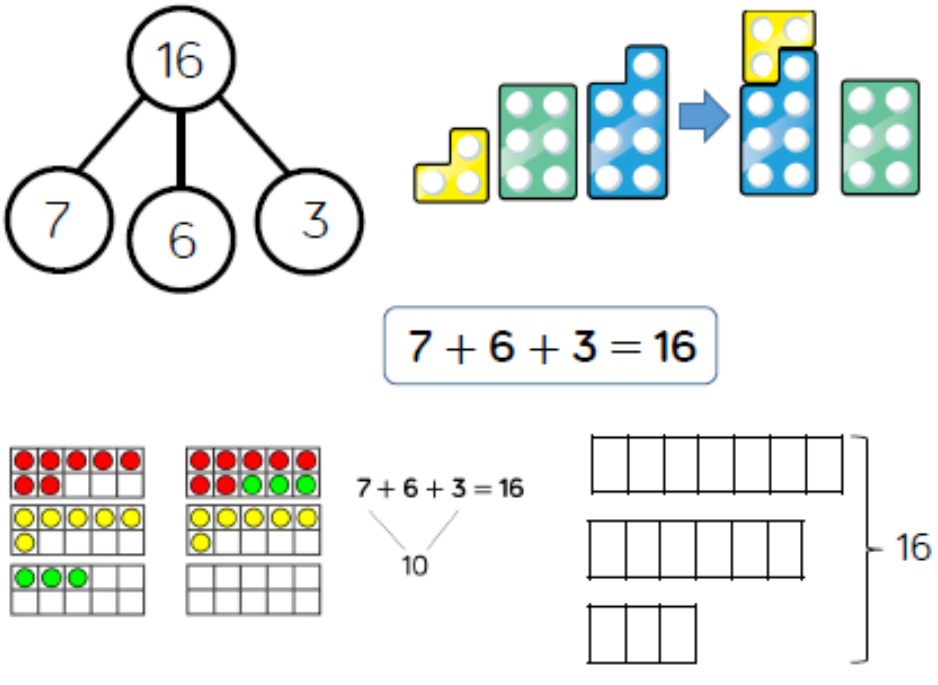
Children can subtract numbers by firstly jumping to the nearest 10. Again, this can be supported by ten frames so children can see how they partition the smaller number into the two separate jumps.

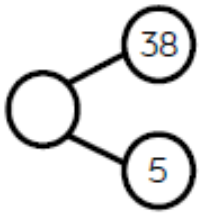
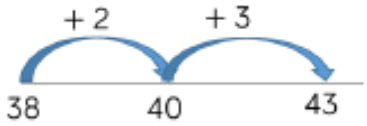
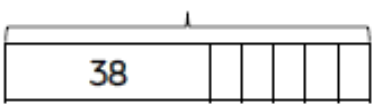
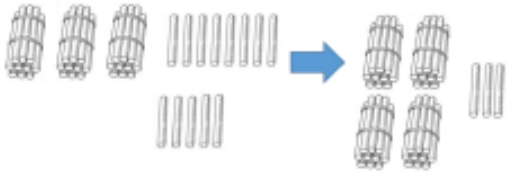
Year 1

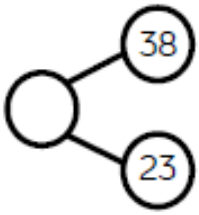
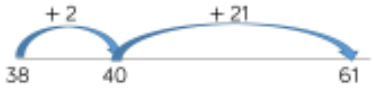
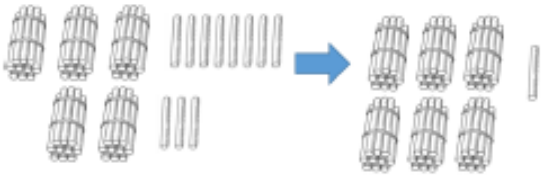
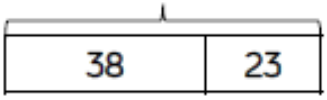
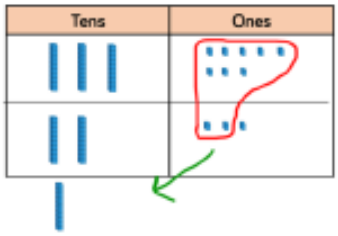
Skill: Add 1-digit numbers within 10	Year: 1
	When adding numbers to 10, children can explore both aggregation and augmentation. The part-whole model, discrete and continuous bar model, number shapes and ten frame support aggregation. The combination bar model, ten frame, bead string and number track all support augmentation.

Skill: Add 1 and 2-digit numbers to 20	Year: 1/2
	When adding one-digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. In Year 1, this is only done just by counting on. From Year 2, use different manipulatives can be used to represent this exchange alongside number lines to support children in understanding how to partition their jumps.

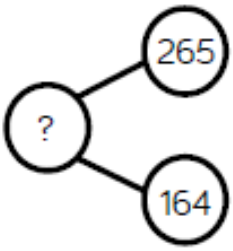
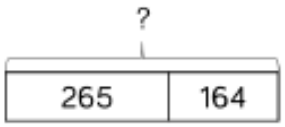
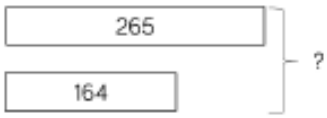
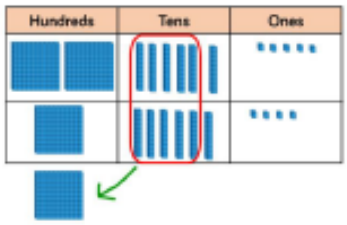
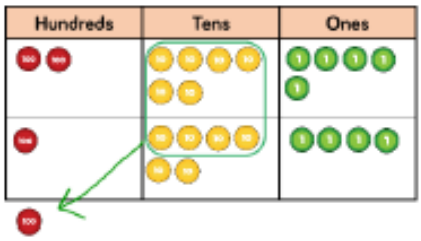
Year 2

Skill: Add three 1-digit numbers	Year: 2
	When adding three 1-digit numbers, children should be encouraged to look for number bonds to 10 or doubles to add the numbers more efficiently. This supports children in their understanding of commutativity. Manipulatives that highlight number bonds to 10 are effective when adding three 1-digit numbers.

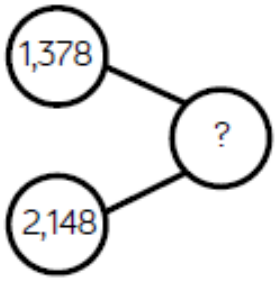
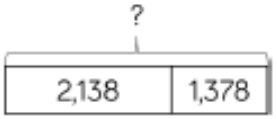
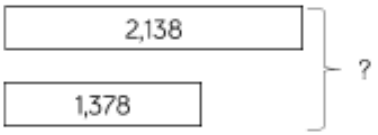
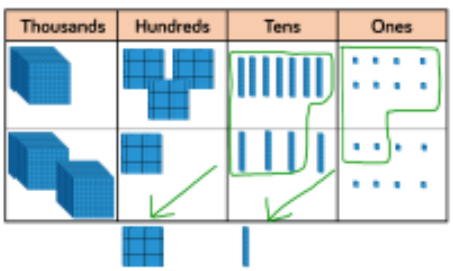
Skill: Add 1-digit and 2-digit numbers to 100	Year: 2/3
    38 + 5 = 43  	When adding single digits to a two-digit number, children should be encouraged to count on from the larger number. They should also apply their knowledge of number bonds to add more efficiently e.g. 8 + 5 = 13 so 38 + 5 = 43. Hundred squares and straws can support children to find the number bond to 10.

Skill: Add two 2-digit numbers to 100	Year: 2/3
    38 + 23 = 61  38 + 23 61 1 	Children can use a blank number line and other representations to count on to find the total. Encourage them to jump to multiples of 10 to become more efficient. From Year 3, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.

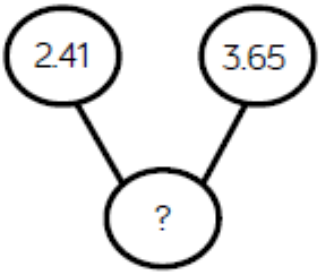
Year 3

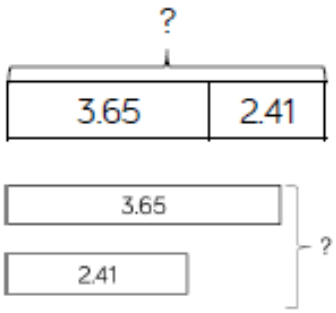
Skill: Add numbers with up to 3 digits	Year: 3
   $265 + 164 = 429$  265 + 164 429 1 	Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 3 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.

Year 4

Skill: Add numbers with up to 4 digits	Year: 4
   1 3 7 8 + 2 1 4 8 3 5 2 6 1 1 $1{,}378 + 2{,}148 = 3{,}526$  	Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 4 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.

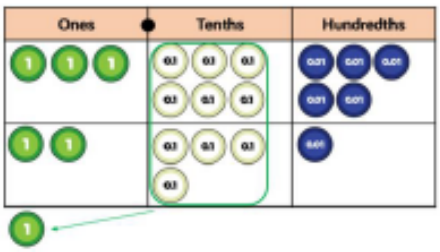
Skill: Add with up to 3 decimal places	Year: 5

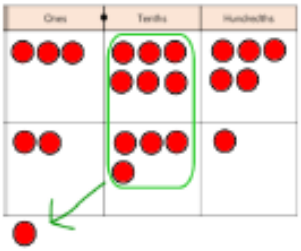




$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

$$3.65 + 2.41 = 6.06$$

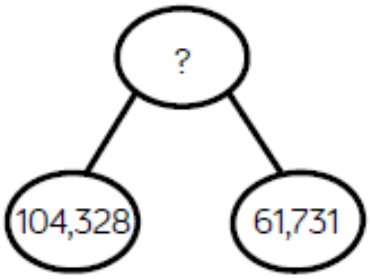


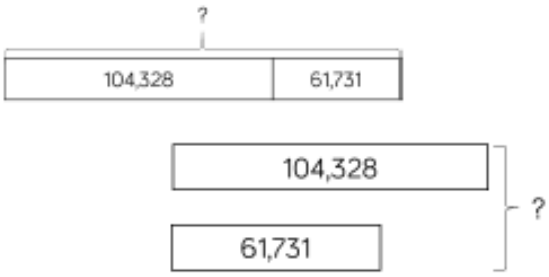


Place value counters and plain counters on a place value grid are the most effective manipulatives when adding decimals with 1, 2 and then 3 decimal places.

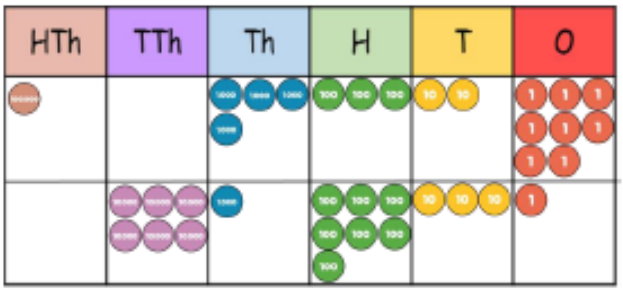
Ensure children have experience of adding decimals with a variety of decimal places. This includes putting this into context when adding money and other measures.

Skill: Add numbers with more than 4 digits	Year: 5/6





$$104{,}328 + 61{,}731 = 166{,}059$$



1	0	4	3	2	8
+	6	1	7	3	1
1	6	6	0	5	9
		1			

Place value counters or plain counters on a place value grid are the most effective concrete resources when adding numbers with more than 4 digits.

At this stage, children should be encouraged to work in the abstract, using the column method to add larger numbers efficiently.

CALCULATION PROGRESSION FOR SUBTRACTION

Minus	Take-away	Less	Reduce	Find the difference

Mental Calculation Strategies for Subtraction

These are a **selection** of mental calculation strategies:

Mental recall of addition and subtraction facts

10 - 6 = 4 17 - ☐ = 11

20 - 17 = 3 10 - ☐ = 2

Find a small difference by counting up

82 – 79 = 3

Counting on or back in repeated steps of 1, 10, 100, 1000

86 - 52 = 34 (by counting back in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 - 19 = 24 - 20 + 1 = 5

458 - 71 = 458 - 70 - 1 = 387

Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

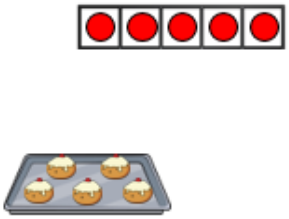
MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Subtraction – Written Calculation, Models & Images

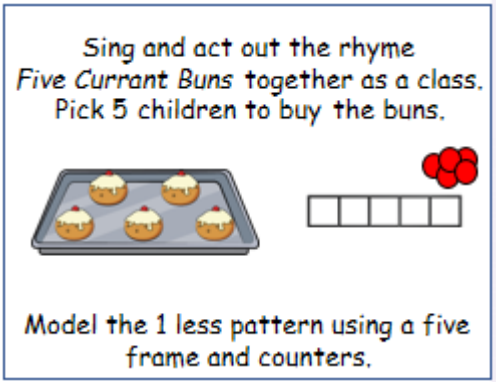
Nursery & Reception

Children are able to understand the concept of taking away from a group of objects and that there will be 'fewer' objects. They will talk about 'less/more' than.

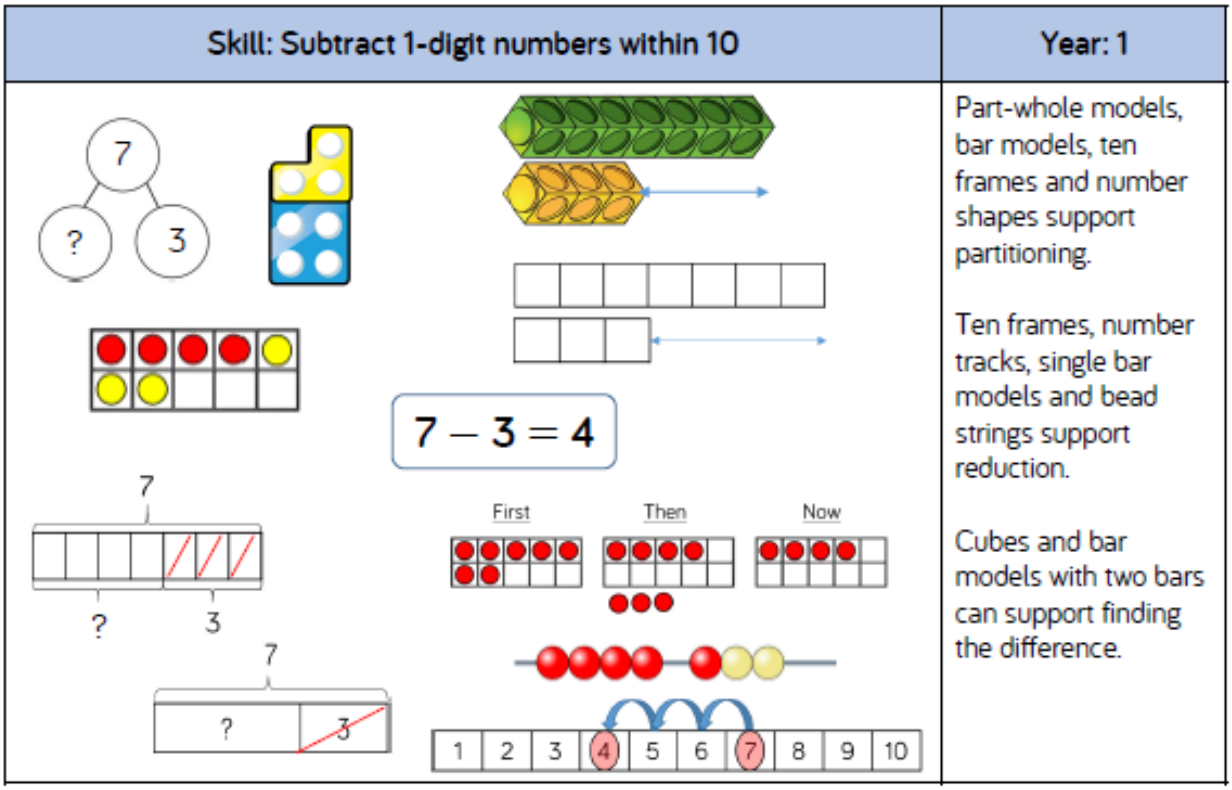
Children will join in with counting back in 1s eg. rocket launch and maths songs.

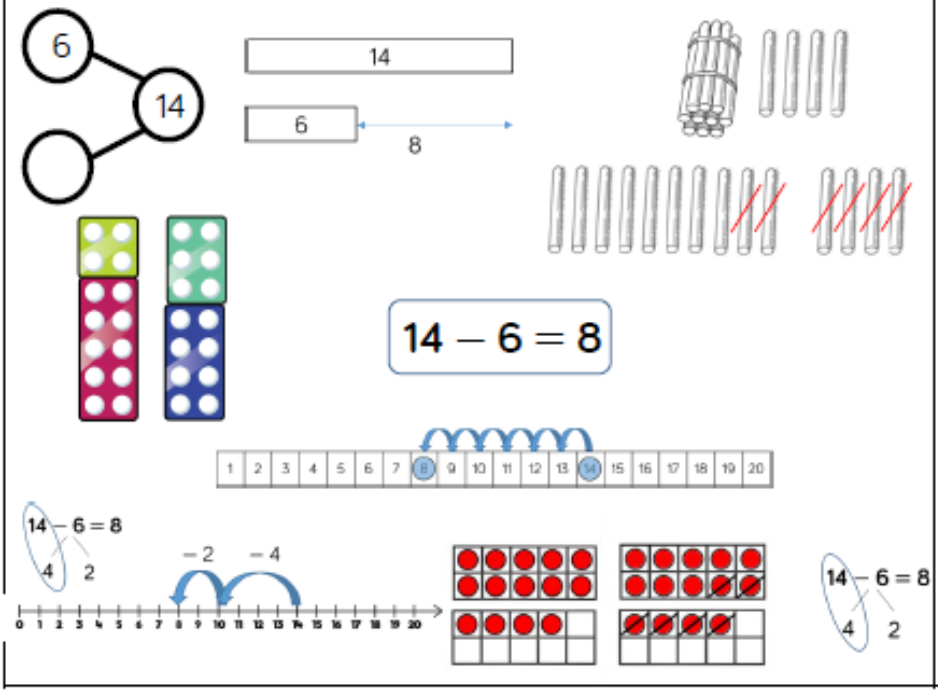


1 less than 5 is 4

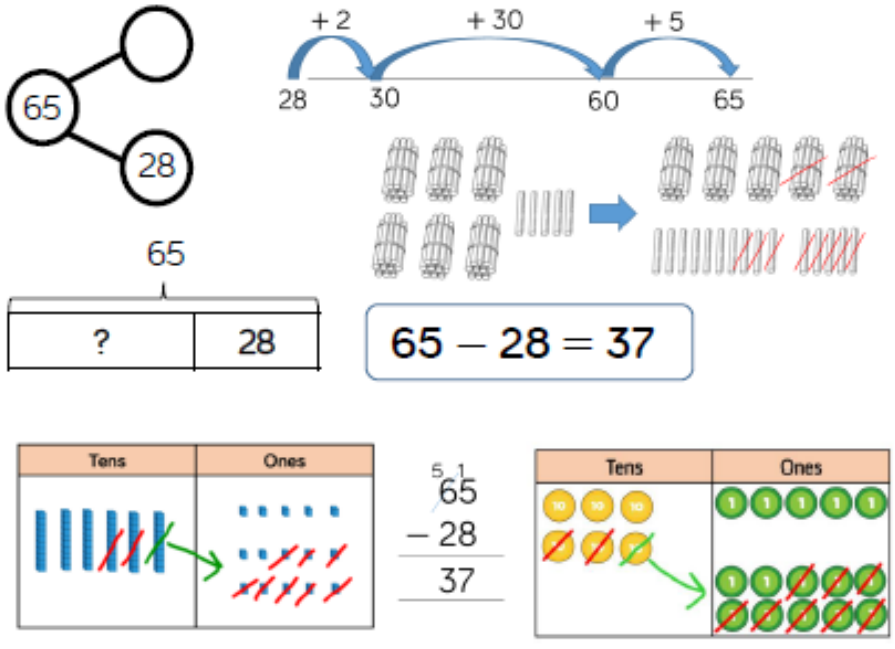


Year 1

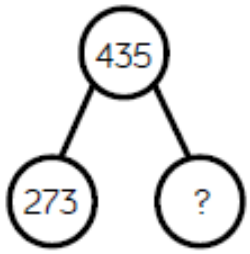
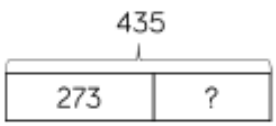
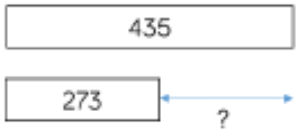
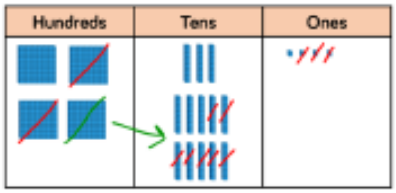
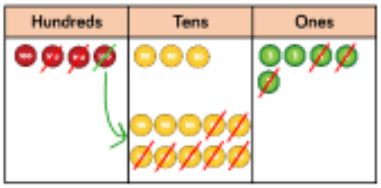


Skill: Subtract 1 and 2-digit numbers to 20	Year: 1/2
	In Year 1, subtracting one-digit numbers that cross 10, is done by counting back, using objects, number tracks and number lines. From Year 2, children should be encouraged to find the number bond to 10 when partitioning the subtracted number. Ten frames, number shapes and number lines are particularly useful for this.

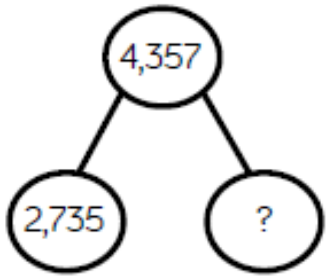
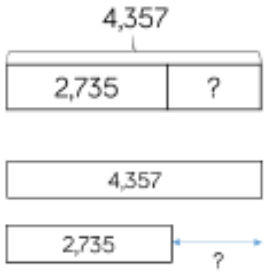
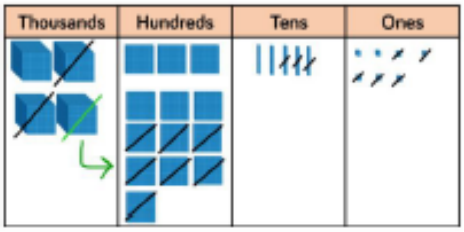
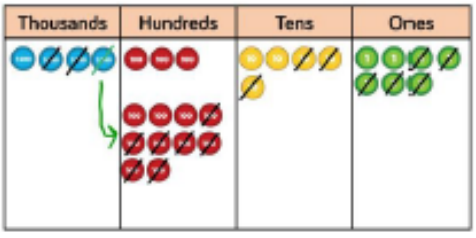
Year 2

Skill: Subtract 1 and 2-digit numbers to 100	Year: 2/3
	Children can also use a blank number line to count back to find the difference. Encourage them to jump to multiples of 10 to become more efficient. From Year 3, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.

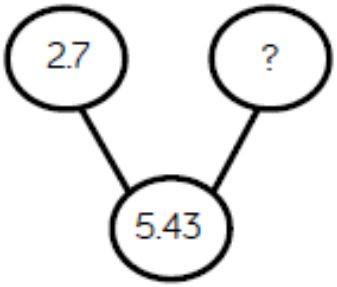
Year 3

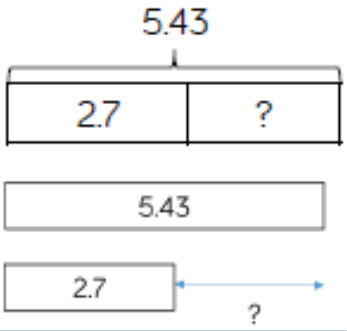
Skill: Subtract numbers with up to 3 digits	Year: 3
   435 − 273 = 162  3 1 4 3 5 − 2 7 3 1 6 2 	Base 10 and place value counters are the most effective manipulative when subtracting numbers with up to 3 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.

Year 4

Skill: Subtract numbers with up to 4 digits	Year: 4
  3 1 4 3 5 7 − 2 7 3 5 1 6 2 2 4,357 − 2,735 = 1,622  	Base 10 and place value counters are the most effective manipulatives when subtracting numbers with up to 4 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.

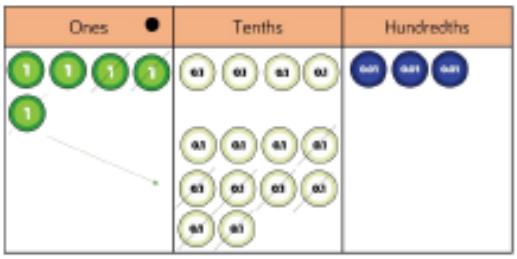
Skill: Subtract with up to 3 decimal places	Year: 5/6

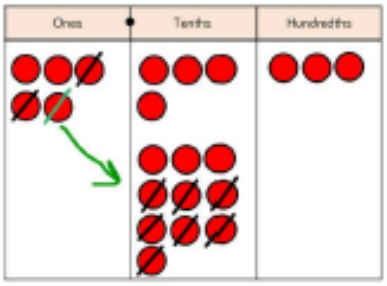




$$\begin{array}{r} {}^{4}\cancel{5}.{}^{1}43 \\ -\ 2.7 \\ \hline 2.73 \end{array}$$

$$5.43 - 2.7 = 2.73$$

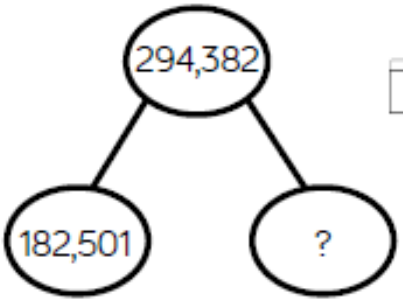


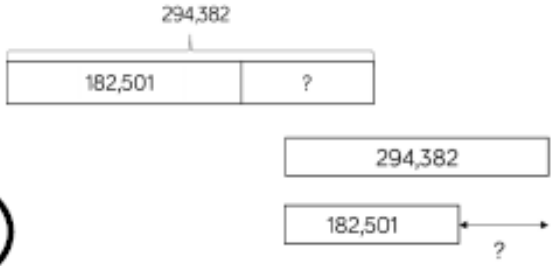


Place value counters and plain counters on a place value grid are the most effective manipulative when subtracting decimals with 1, 2 and then 3 decimal places.

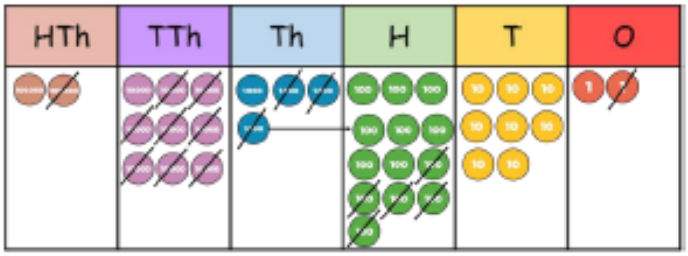
Ensure children have experience of subtracting decimals with a variety of decimal places. This includes putting this into context when subtracting money and other measures.

Skill: Subtract numbers with more than 4 digits	Year: 5/6





$$294{,}382 - 182{,}501 = 111{,}881$$



	2	9	$\cancel{3}$	$^{1}3$	8	2
−	1	8	2	5	0	1
	1	1	1	8	8	1

Place value counters or plain counters on a place value grid are the most effective concrete resource when subtracting numbers with more than 4 digits.

At this stage, children should be encouraged to work in the abstract, using column method to subtract larger numbers efficiently.

Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.

CALCULATION PROGRESSION FOR MULTIPLICATION

Times	Lots of...	Product	Double	Groups of...
Multiple		Repeated addition	Array	

Mental Calculation Strategies for Multiplication

These are a **selection** of mental calculation strategies:

- **Doubling and halving – this is really important!!!!!!!!! Children need to know doubles from 1 – 9 by heart and related halves. They must also be taught how to relate these to doubling multiples of 10 and then to partition and double 2 and 3 digit numbers.**

- **Applying the knowledge of doubles and halves to known facts.**
- **e.g. 8 x 4 is double 4 x 4**

- **Using multiplication facts**

Tables should be taught everyday from the last term of year 1 onwards, either as part of the mental oral starter or other times as appropriate within the day, particularly using the times table tournament and chanting through transitions.

Year 1-2
2 times table
10 times table
5 times table

Year 3
2 times table
10 times table
5 times table
4 times table
3 times table
6 times table

Year 4 Derive and recall all multiplication facts up to 12 x 12

Years 5 & 6 Derive and recall quickly all multiplication facts up to 12x 12.

Using and applying division facts
Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Use closely related facts already known
13 x 11 = (13 x 10) + (13 x 1)
= 130 + 13
= 143

Multiply by 10 or 100
Know that the effect of multiplying by 10 is a shift in the digits one place to the left.
Know that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partition
23 x 4 = (20 x 4) + (3 x 4)
= 80 + 12
= 92

Use of factors
8 x 12 = 8 x 4 x 3

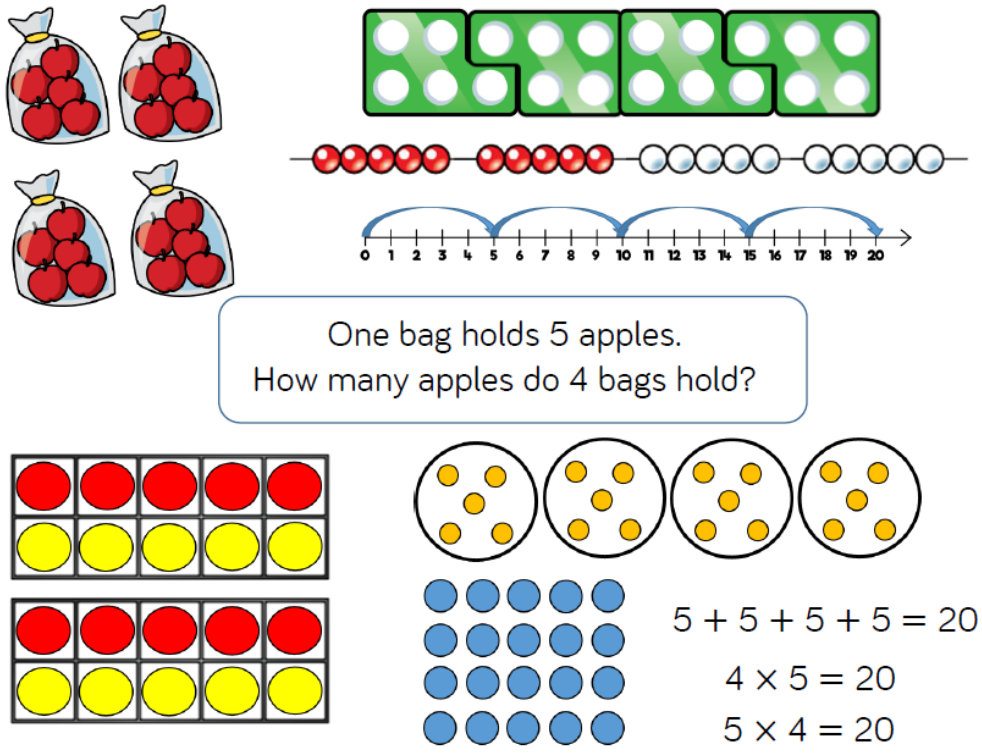
Find prime factors and know prime and composite numbers.
Understand and identify shared factors.

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

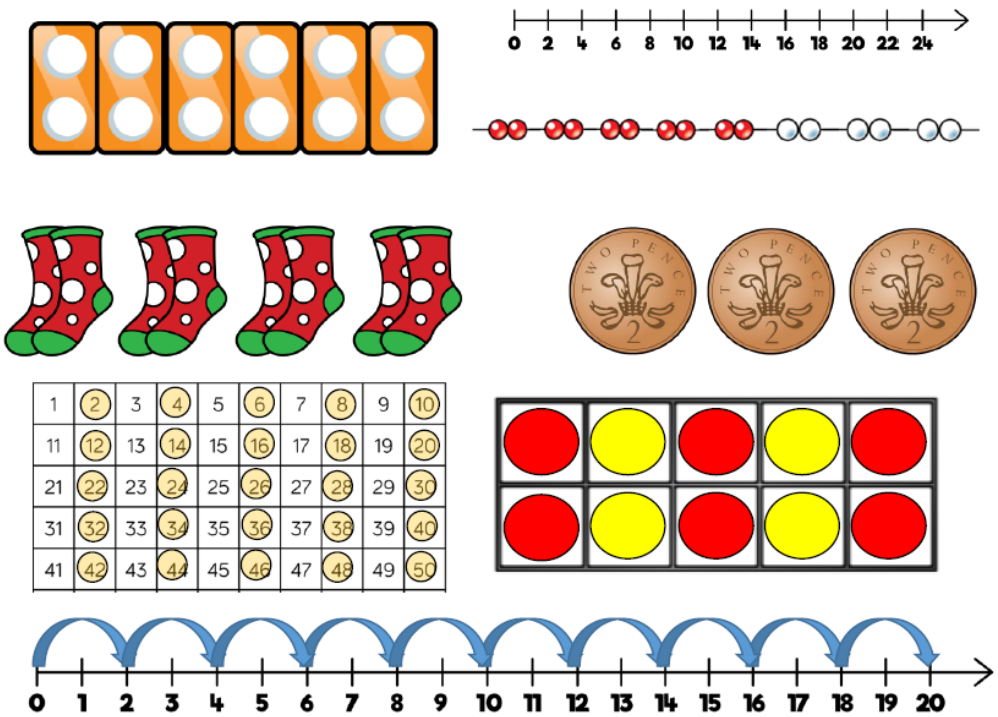
Multiplication – Written Calculation, Models & Images

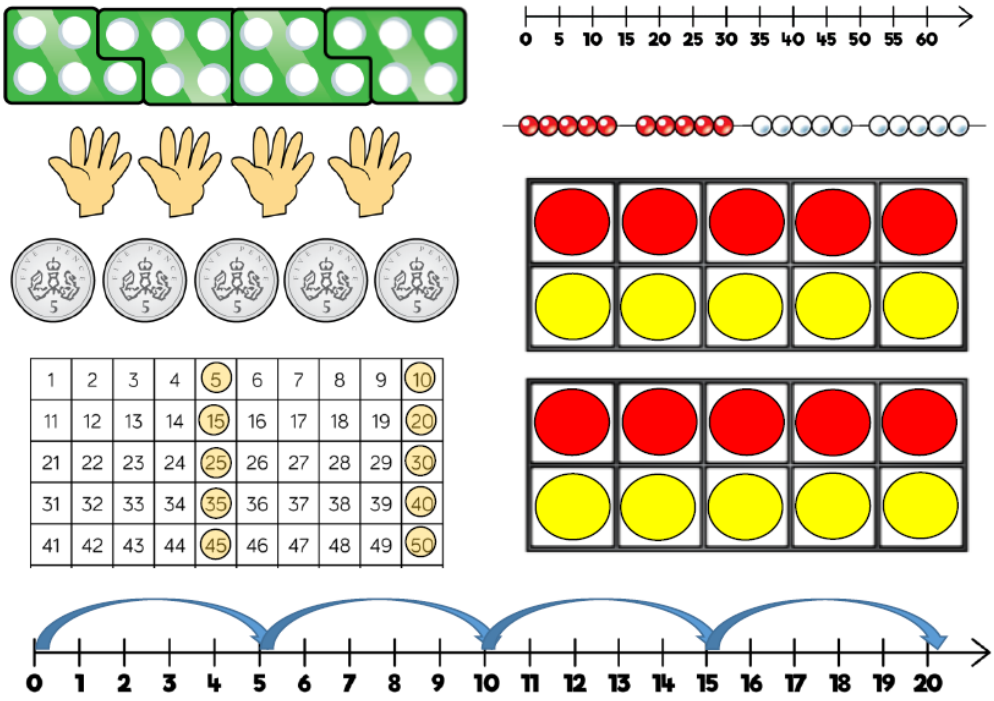
Nursery & Reception

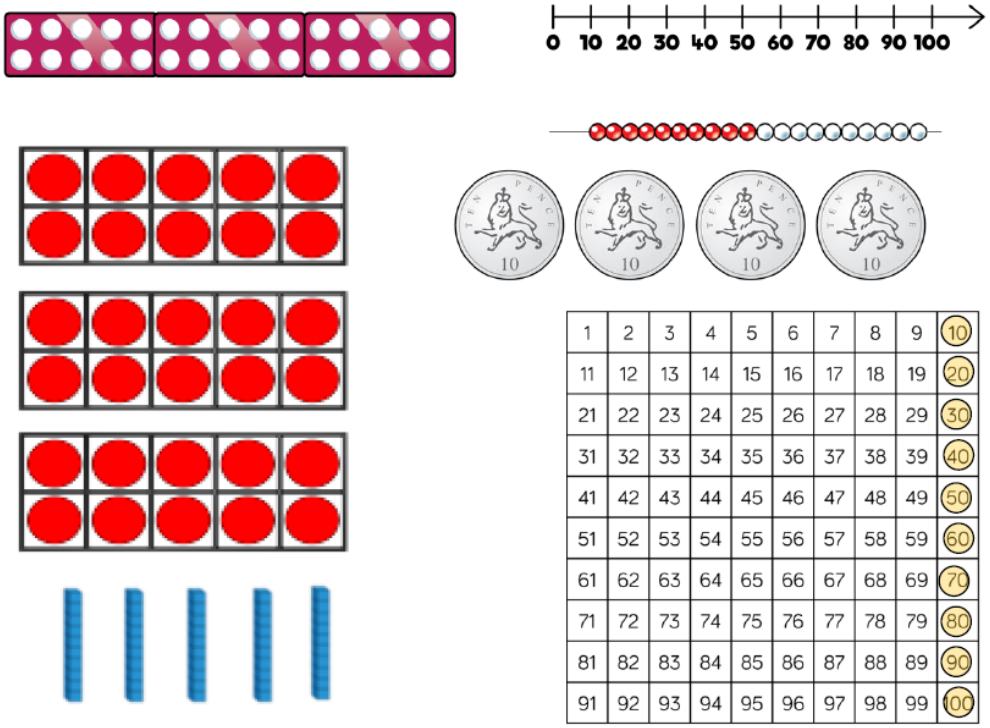
Children will experience equal groups of objects, creating patterns and sorting objects. They will work on practical problem solving activities involving equal sets or groups and sharing.

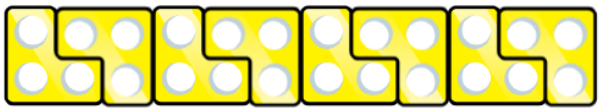
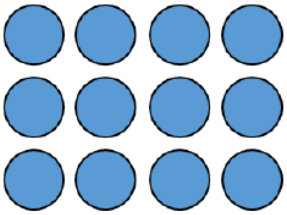
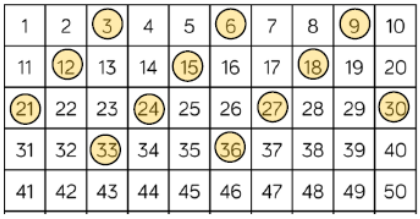
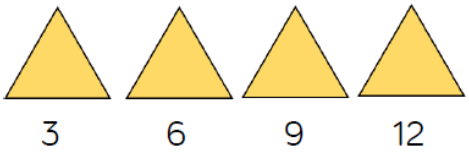
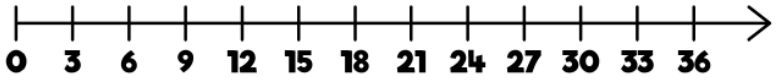
Skill: Solve 1-step problems using multiplication	Year: 1/2
	Children represent multiplication as repeated addition in many different ways. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record multiplication formally. In Year 2, children are introduced to the multiplication symbol.

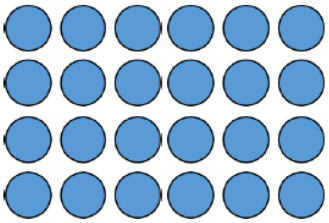
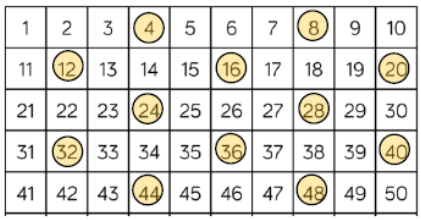
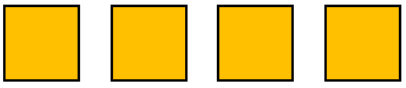
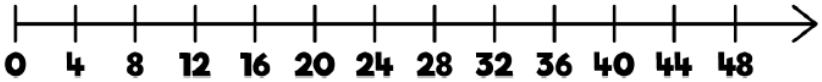
Y2

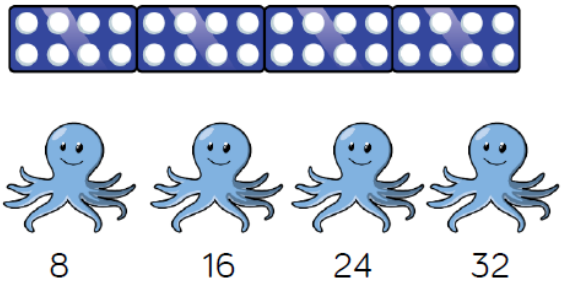
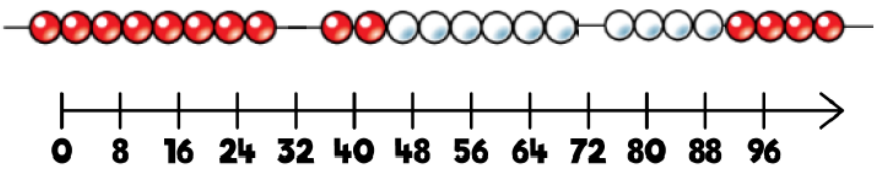
Skill: 2 times table	Year: 2
	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the two times table, using concrete manipulatives to support. Notice how all the numbers are even and there is a pattern in the ones. Use different models to develop fluency.

Skill: 5 times table	Year: 2
	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the five times table, using concrete manipulatives to support. Notice the pattern in the ones as well as highlighting the odd, even, odd, even pattern.

Skill: 10 times table	Year: 2
	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the ten times table, using concrete manipulatives to support. Notice the pattern in the digits- the ones are always 0, and the tens increase by 1 ten each time.

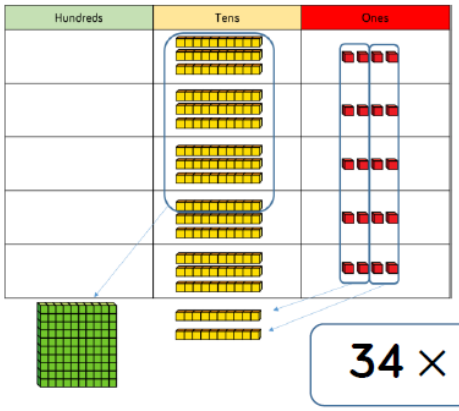
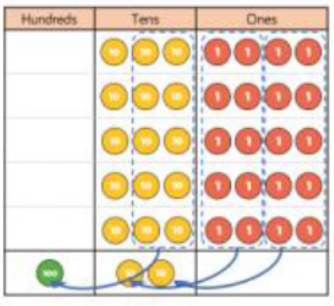
Skill: 3 times table	Year: 3
    3 6 9 12   0 3 6 9 12 15 18 21 24 27 30 33 36	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the three times table, using concrete manipulatives to support. Notice the odd, even, odd, even pattern using number shapes to support. Highlight the pattern in the ones using a hundred square.

Skill: 4 times table	Year: 3
    4 8 12 16 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60   0 4 8 12 16 20 24 28 32 36 40 44 48	Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the four times table, using manipulatives to support. Make links to the 2 times table, seeing how each multiple is double the twos. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

Skill: 8 times table	Year: 3
 8 16 24 32 40 48 56 64 72 80  	Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the eight times table, using manipulatives to support. Make links to the 4 times table, seeing how each multiple is double the fours. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

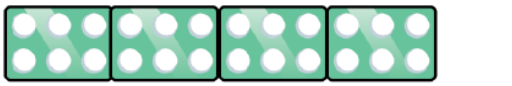
1 2 3 4 5 6 7 **8** 9 10
11 12 13 14 15 **16** 17 18 19 20
21 22 23 **24** 25 26 27 28 29 30
31 **32** 33 34 35 36 37 38 39 **40**
41 42 43 44 45 46 47 **48** 49 50
51 52 53 54 55 **56** 57 58 59 60
61 62 63 **64** 65 66 67 68 69 70
71 **72** 73 74 75 76 77 78 79 **80**
81 82 83 84 85 86 87 88 89 90
91 92 93 94 95 96 97 98 99 100

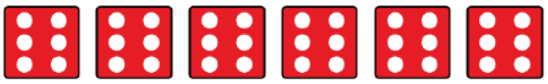
Years 3 & 4

Skill: Multiply 2-digit numbers by 1-digit numbers	Year: 3/4
 H T O 3 4 × 5 2 0 (5 × 4) + 1 5 0 (5 × 30) 1 7 0 $34 \times 5 = 170$ H T O 3 4 × 5 1 7 0 1 2  	Informal methods and the expanded method are used in Year 3 before moving on to the short multiplication method in Year 4. Place value counters should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge.

Year 4

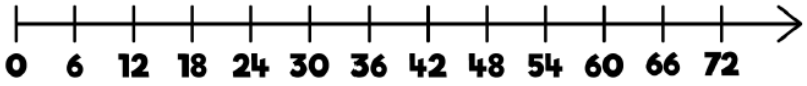
Skill: 6 times table	Year: 4





6	12	18	24	30
36	42	48	54	60
66	72	78	84	90

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

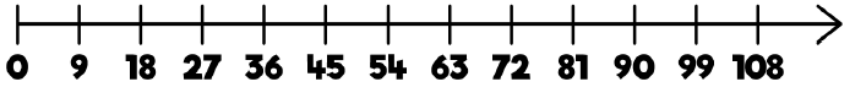


Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the six times table, using manipulatives to support. Make links to the 3 times table, seeing how each multiple is double the threes. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

Skill: 9 times table	Year: 4

9	18	27	36	45
54	63	72	81	90

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



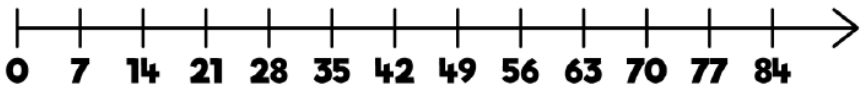
Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the nine times table, using concrete manipulatives to support. Notice the pattern in the tens and ones using the hundred square to support as well as noting the odd, even pattern within the multiples.

Skill: 7 times table

Year: 4

7	14	21	28	35
42	49	56	63	70

1	2	3	4	5	6	(7)	8	9	10
11	12	13	(14)	15	16	17	18	19	20
(21)	22	23	24	25	26	27	(28)	29	30
31	32	33	34	(35)	36	37	38	39	40
41	(42)	43	44	45	46	47	48	(49)	50
51	52	53	54	55	(56)	57	58	59	60
61	62	(63)	64	65	66	67	68	69	(70)
71	72	73	74	75	76	(77)	78	79	80
81	82	83	(84)	85	86	87	88	89	90
(91)	92	93	94	95	96	97	(98)	99	100

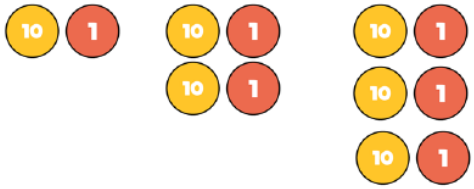


Encourage daily counting in multiples both forwards and backwards, supported by a number line or a hundred square.
The seven times table can be trickier to learn due to the lack of obvious pattern in the numbers, however they already know several facts due to commutativity.
Children can still see the odd, even pattern in the multiples using number shapes to support.

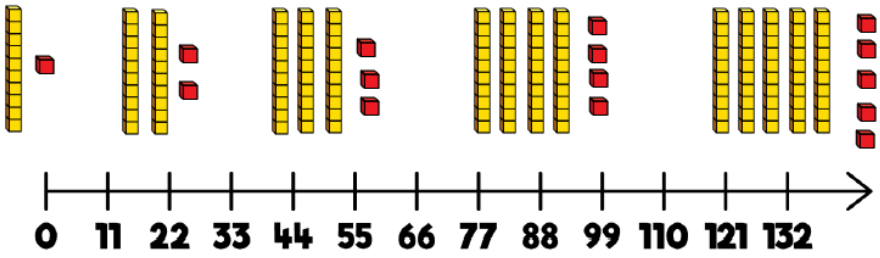
Skill: 11 times table

Year: 4

11	22	33	44	55	66
77	88	99	110	121	132



1	2	3	4	5	6	7	8	9	10
(11)	12	13	14	15	16	17	18	19	20
21	(22)	23	24	25	26	27	28	29	30
31	32	(33)	34	35	36	37	38	39	40
41	42	43	(44)	45	46	47	48	49	50
51	52	53	54	(55)	56	57	58	59	60
61	62	63	64	65	(66)	67	68	69	70
71	72	73	74	75	76	(77)	78	79	80
81	82	83	84	85	86	87	(88)	89	90
91	92	93	94	95	96	97	98	(99)	100



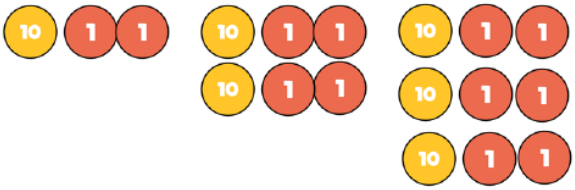
Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.

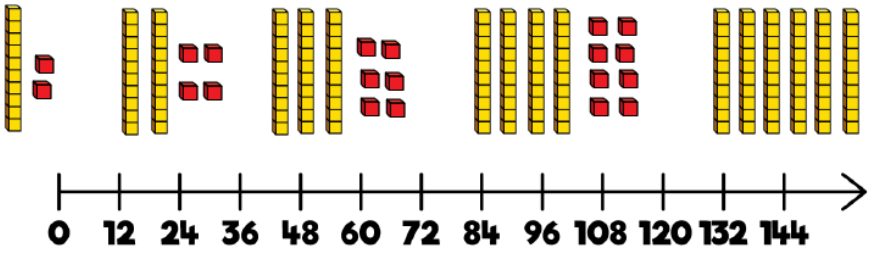
Look for patterns in the eleven times table, using concrete manipulatives to support. Notice the pattern in the tens and ones using the hundred square to support. Also consider the pattern after crossing 100

Skill: 12 times table	Year: 4

12	24	36	48	60
72	84	96	108	120
132	144			

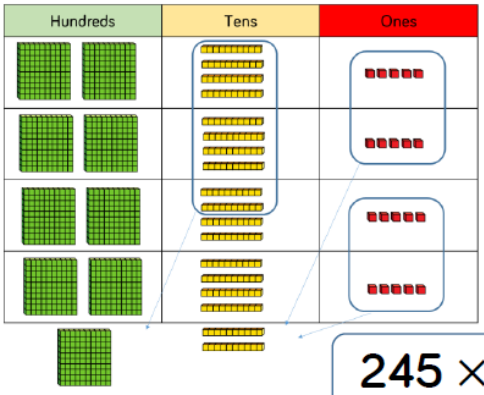
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100





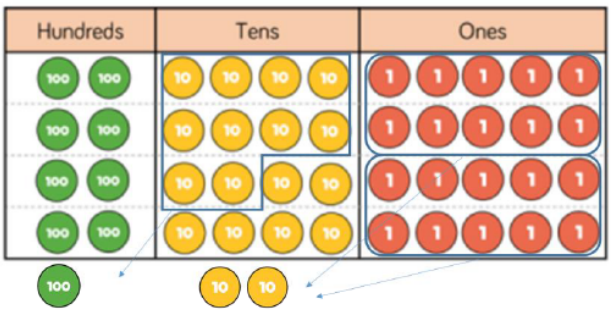
Encourage daily counting in multiples, supported by a number line or a hundred square.
Look for patterns in the 12 times table, using manipulatives to support. Make links to the 6 times table, seeing how each multiple is double the sixes. Notice the pattern in the ones within each group of five multiples. The hundred square can support in highlighting this pattern.

Skill: Multiply 3-digit numbers by 1-digit numbers	Year: 4



	H	T	O
	2	4	5
×			4
	9	8	0
	1	2	

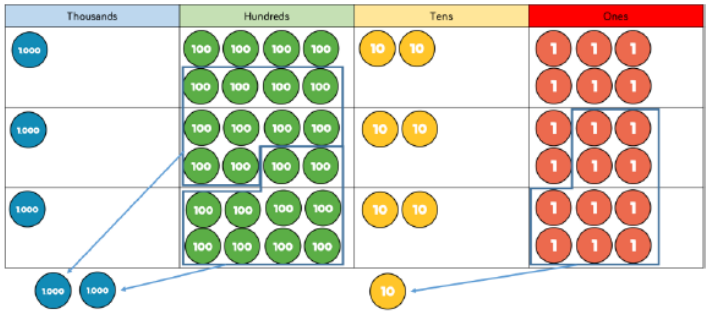
$$245 \times 4 = 980$$



When moving to 3-digit by 1-digit multiplication, encourage children to move towards the short, formal written method.
Base 10 and place value counters continue to support the understanding of the written method.
Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.

Skill: Multiply 4-digit numbers by 1-digit numbers

Year: 5



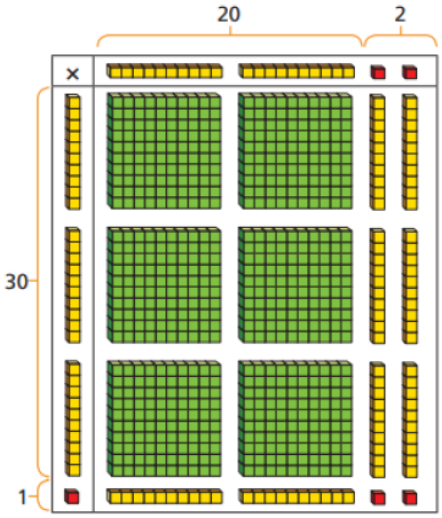
$$1{,}826 \times 3 = 5{,}478$$

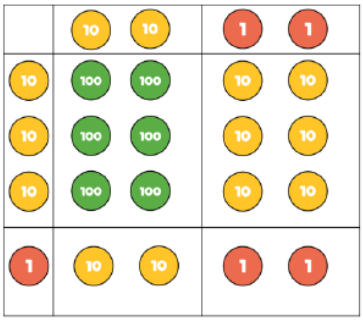
	Th	H	T	O
	1	8	2	6
×				3
	5	4	7	8
	2		1	

When multiplying 4-digit numbers, place value counters are the best manipulative to use to support children in their understanding of the formal written method.
If children are multiplying larger numbers and struggling with their times tables, encourage the use of multiplication grids so children can focus on the use of the written method.

Skill: Multiply 2-digit numbers by 2-digit numbers

Year: 5





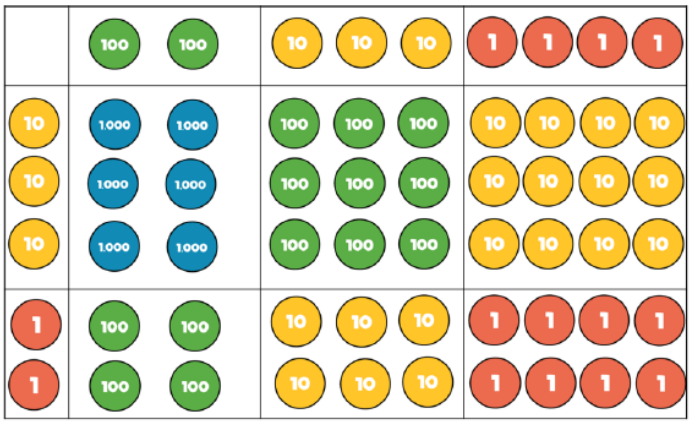
×	20	2
30	600	60
1	20	2

	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

$$22 \times 31 = 682$$

When multiplying a multi-digit number by 2-digits, use the area model to help children understand the size of the numbers they are using. This links to finding the area of a rectangle by finding the space covered by the Base 10.
The grid method matches the area model as an initial written method before moving on to the formal written multiplication method.

Skill: Multiply 3-digit numbers by 2-digit numbers	Year: 5



Th	H	T	O
	2	3	4
×		3	2
	4	6	8
$^{1}7$	$^{1}0$	2	0
7	4	8	8

×	200	30	4
30	6,000	900	120
2	400	60	8

$234 \times 32 = 7{,}488$

Children can continue to use the area model when multiplying 3-digits by 2-digits. Place value counters become more efficient to use but Base 10 can be used to highlight the size of numbers.

Children should now move towards the formal written method, seeing the links with the grid method.

Skill: Multiply 4-digit numbers by 2-digit numbers	Year: 5/6

TTh	Th	H	T	O
	2	7	3	9
×			2	8
$^{2}2$	$^{5}1$	$^{3}9$	$^{7}1$	2
$^{1}5$	4	$^{1}7$	8	0
7	6	6	9	2
		1		

$2{,}739 \times 28 = 76{,}692$

When multiplying 4-digits by 2-digits, children should be confident in using the formal written method.

If they are still struggling with times tables, provide multiplication grids to support when they are focusing on the use of the method.

Consider where exchanged digits are placed and make sure this is consistent.

CALCULATION PROGRESSION FOR DIVISION

Share	group	lots of	split	divide into

Mental Calculation Strategies for Division

These are a **selection** of mental calculation strategies:

Doubling and halving

Knowing that halving is dividing by 2

Deriving and recalling division facts

Tables should be taught everyday from the last term of year 1 onwards, either as part of the mental oral starter or other times as appropriate within the day, particularly using the times table tournament and asking questions such as 'what will the remainder be if I divide 37 by 5?

Year 1-2	2 times table 10 times table 5 times table
Year 3	2 times table 10 times table 5 times table 4 times table 3 times table 6 times table
Year 4	Derive and recall division facts for all tables up to 12 x 12
Year 5 & 6	Derive and recall quickly division facts for all tables up to 12 x 12

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.
e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.
Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Use of factors

378 ÷ 21 378 ÷ 3 = 126 378 ÷ 21 = 18
126 ÷ 7 = 18

Use related facts

Given that 1.4 x 1.1 = 1.54
What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

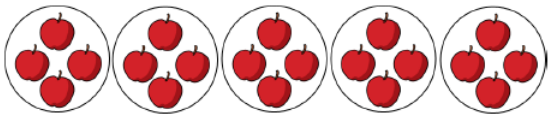
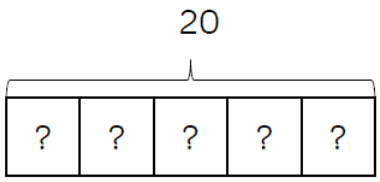
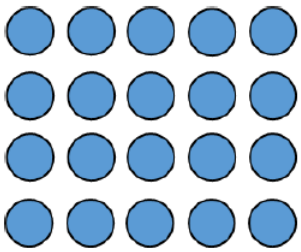
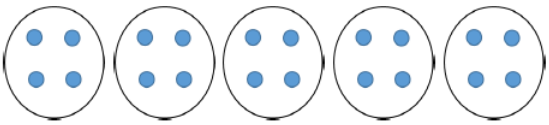
Division – Written Calculation, Models & Images

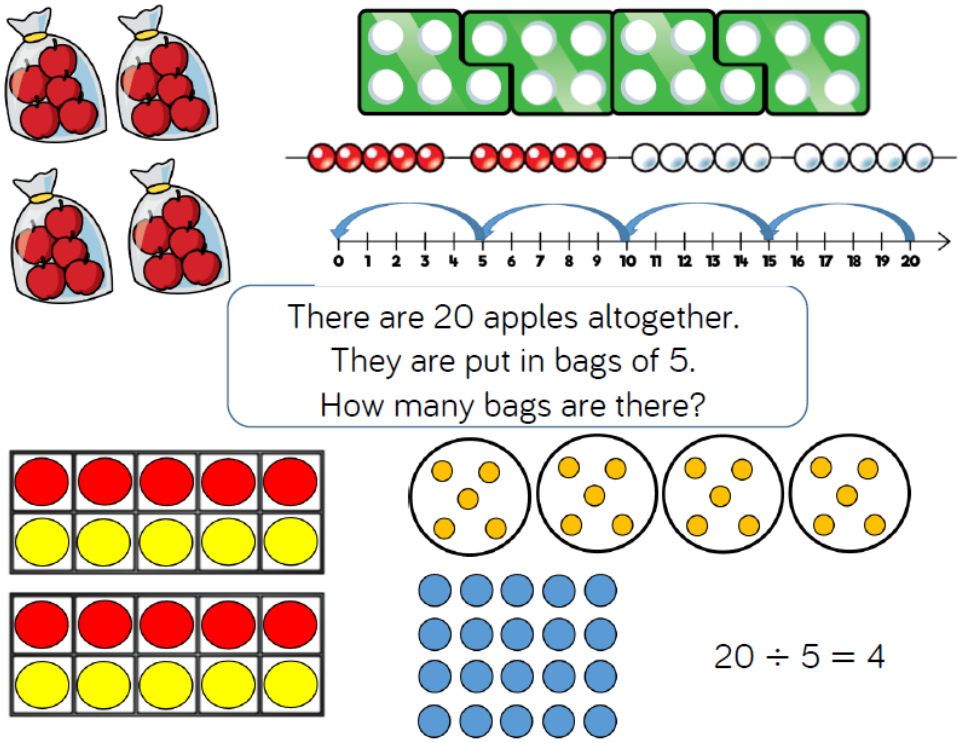
Focus on inverse for ages. Need to know number facts. Repeated subtraction in the same way as repeated addition.
When teaching times tables include all division facts i.e all fact families.
*Short division using place value counters…….*******Ask Gareth Netley*
Keep chunking – ***chunking forward?????? Go straight to the formal long division method in Year 6 (where you bring down the digits)***

Nursery & Reception

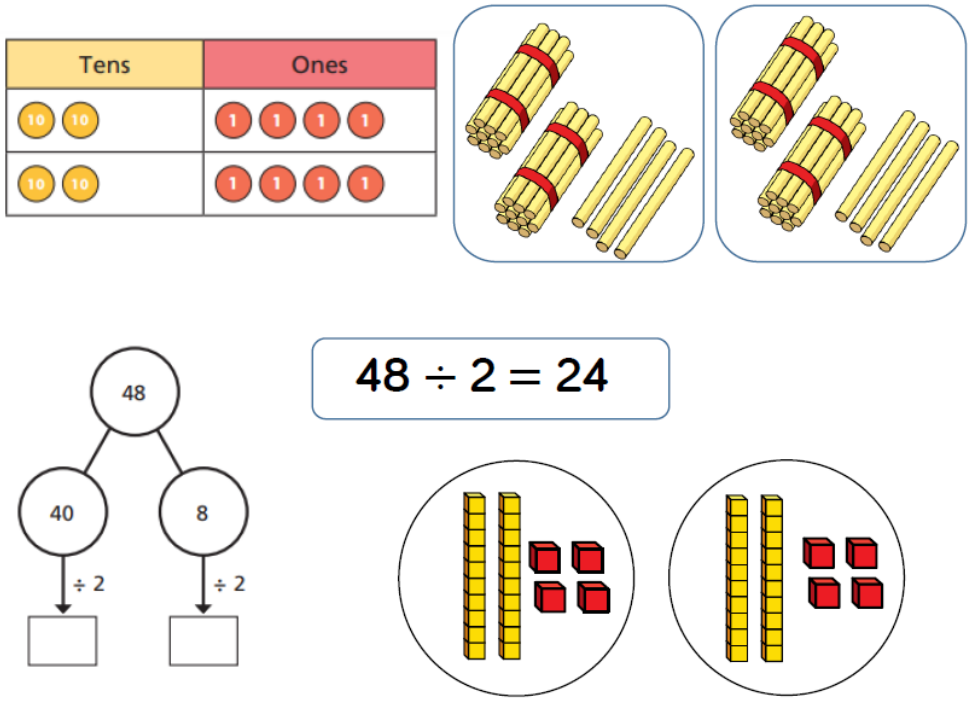
Children will begin to share items and count how many they have if objects are shared. They will start to understand the terms 'groups' and 'share'.

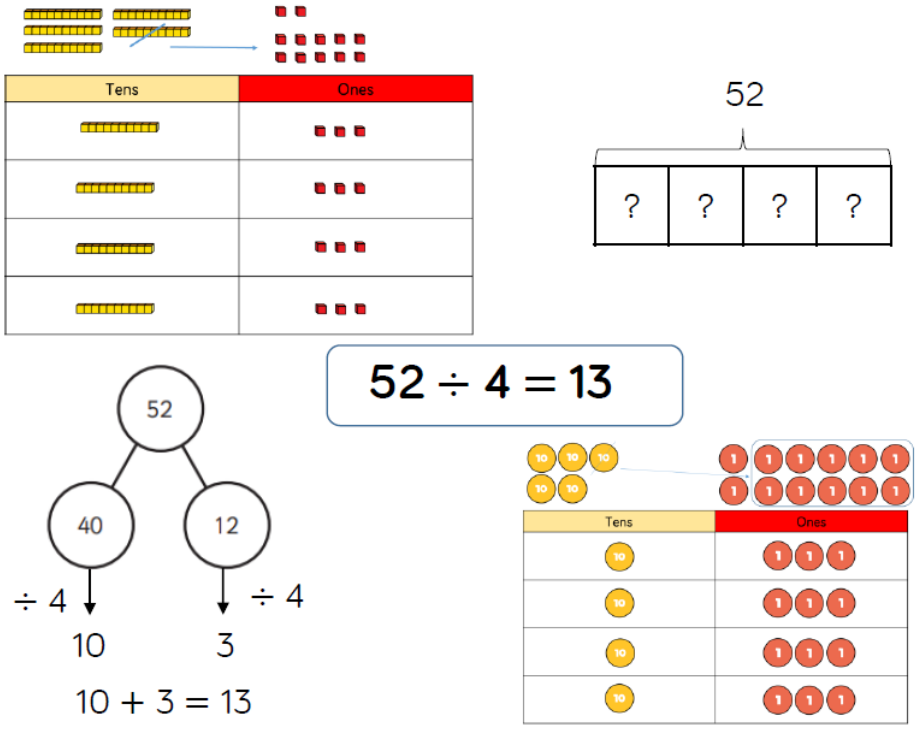
Years 1 & 2

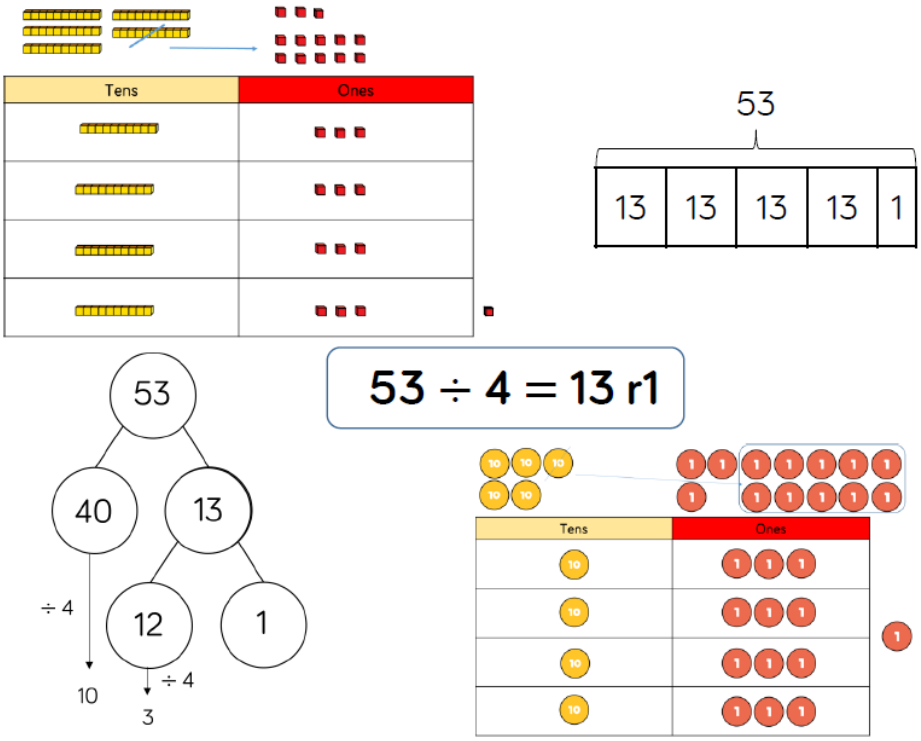
Skill: Solve 1-step problems using multiplication (sharing)	Year: 1/2
  There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?   20 ÷ 5 = 4	Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally. In Year 2, children are introduced to the division symbol.

Skill: Solve 1-step problems using division (grouping)	Year: 1/2
	Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.

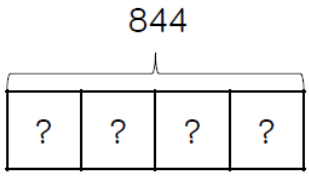
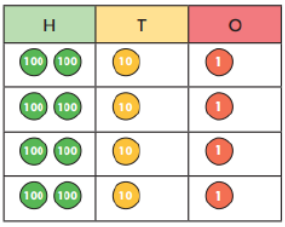
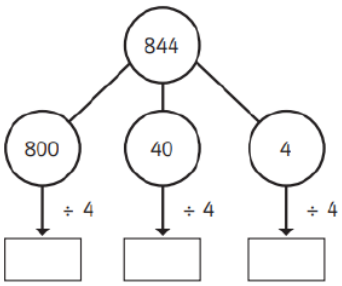
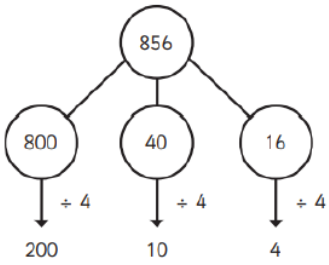
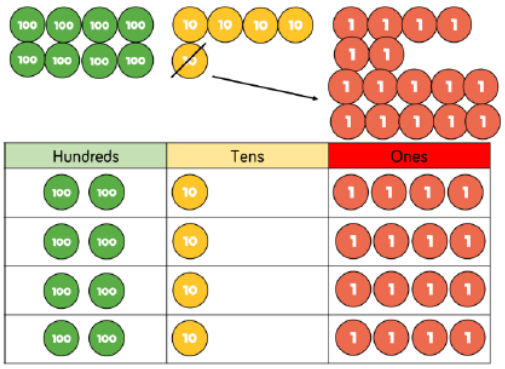
Year 3

Skill: Divide 2-digits by 1-digit (sharing with no exchange)	Year: 3
	When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones. Straws, Base 10 and place value counters can all be used to share numbers into equal groups. Part-whole models can provide children with a clear written method that matches the concrete representation.

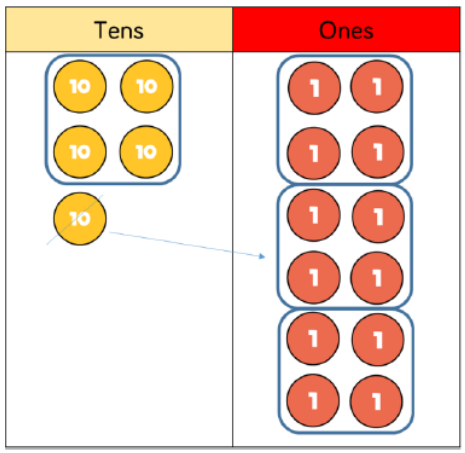
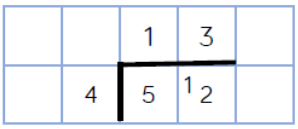
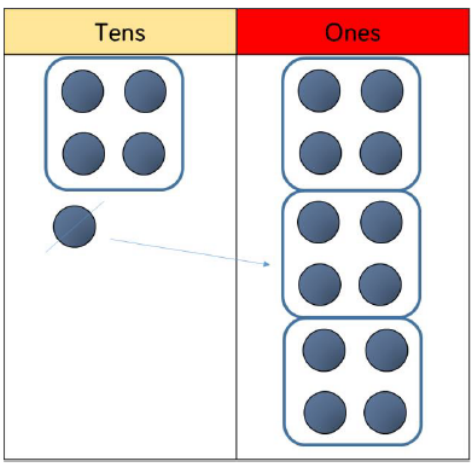
Skill: Divide 2-digits by 1-digit (sharing with exchange)	Year: 3/4
	When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones. Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows. Flexible partitioning in a part-whole model supports this method.

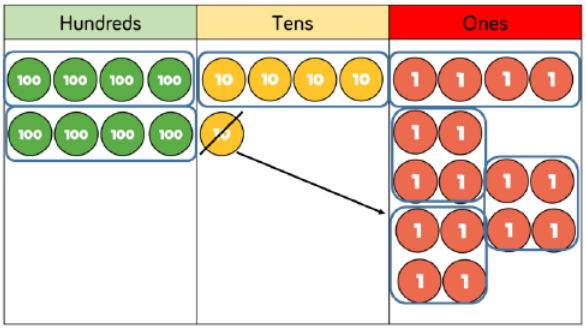
Skill: Divide 2-digits by 1-digit (sharing with remainders)	Year: 3/4
	When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones. Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made. Flexible partitioning in a part-whole model supports this method.

Year 4

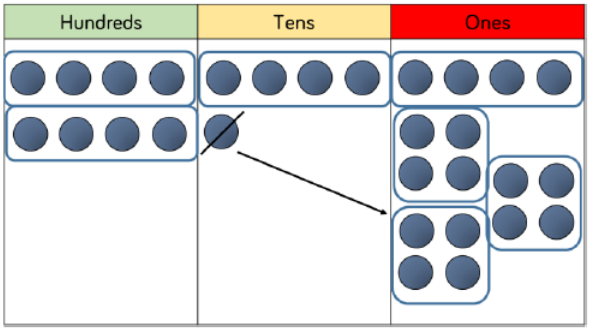
Skill: Divide 3-digits by 1-digit (sharing)	Year: 4
844 ÷ 4 = 211    **856 ÷ 4 = 214**  	Children can continue to use place value counters to share 3-digit numbers into equal groups. Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows. This method can also help to highlight remainders. Flexible partitioning in a part-whole model supports this method.

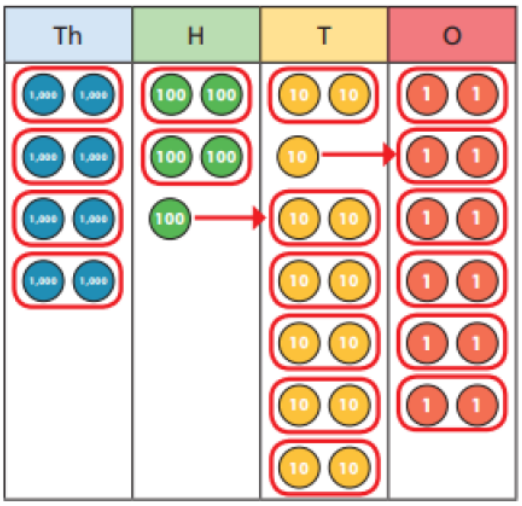
Year 5

Skill: Divide 2-digits by 1-digit (grouping)	Year: 5
   **52 ÷ 4 = 13**	When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor. Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?' Remainders can also be seen as they are left ungrouped.

Skill: Divide 3-digits by 1-digit (grouping)	Year: 5
 $856 \div 4 = 214$	Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number. Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

		2	1	4
	4	8	5	$^{1}6$



Skill: Divide 4-digits by 1-digit (grouping)	Year: 5
 $8,532 \div 2 = 4,266$	Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method. Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges.

	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

Year 6

Skill: Divide multi digits by 2-digits (short division)	Year: 6

		0	3	6
	12	4	4_{3}	7_{2}

432 ÷ 12 = 36

7,335 ÷ 15 = 489

	0	4	8	9
15	7	7_{3}	13_{3}	13_{5}

15	30	45	60	75	90	105	120	135	150

When children begin to divide up to 4-digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Skill: Divide multi-digits by 2-digits (long division)	Year: 6

		0	3	6
1	2	4	3	2
	–	3	6	0
			7	2
	–		7	2
				0

(×30)

(×6)

12 × 1 = 12
12 × 2 = 24
12 × 3 = 36
12 × 4 = 48
12 × 5 = 60
12 × 6 = 72
12 × 7 = 84
12 × 8 = 96
12 × 7 = 108
12 × 10 = 120

432 ÷ 12 = 36

7,335 ÷ 15 = 489

	0	4	8	9	
15	7	3	3	5	
–	6	0	0	0	(×400
	1	3	3	5	
–	1	2	0	0	(×80)
		1	3	5	
–		1	3	5	(×9)
				0	

1 × 15 = 15
2 × 15 = 30
3 × 15 = 45
4 × 15 = 60
5 × 15 = 75
10 × 15 = 150

Children can also divide by 2-digit numbers using long division.

Children can write out multiples to support their calculations with larger remainders.

Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Skill: Divide multi digits by 2-digits (long division)	Year: 6

$372 \div 15 = 24\ r12$

			2	4	r	1	2
1	5	3	7	2			
	–	3	0	0			
			7	2			
	–		6	0			
			1	2			

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

When a remainder is left at the end of a calculation, children can either leave it as a remainder or convert it to a fraction.
This will depend on the context of the question.

Children can also answer questions where the quotient needs to be rounded according to the context.

			2	4	$\frac{4}{5}$
1	5	3	7	2	
	–	3	0	0	
			7	2	
	–		6	0	
			1	2	

$372 \div 15 = 24\frac{4}{5}$

Glossary

Array – An ordered collection of counters, cubes or other item in rows and columns.

Commutative – Numbers can be multiplied in any order.

Dividend – In division, the number that is divided.

Divisor – In division, the number by which another is divided.

Exchange – Change a number or expression for another of an equal value.

Factor – A number that multiplies with another to make a product.

Multiplicand – In multiplication, a number to be multiplied by another.

Partitioning – Splitting a number into its component parts.

Product – The result of multiplying one number by another.

Quotient – The result of a division

Remainder – The amount left over after a division when the divisor is not a factor of the dividend.

Scaling – Enlarging or reducing a number by a given amount, called the scale factor

If a child is finding something challenging, is avoiding a task or is distracted, think:

HOW CAN WE MAKE THIS VISUAL?

HOW CAN WE MAKING THIS RELEVANT TO REAL LIFE?

HOW CAN WE REFER BACK TO WHAT THEY *DO* KNOW?

HOW CAN WE MAKE IT EASIER SO THE CHILD CAN SUCCEED?

HOW CAN WE MAKE THIS MORE FUN?

Created by Lynley Benbetka, November 2023

This policy has been written with reference to the 'White Rose Calculation Policy', revised numeracy strategy 'Guidance on Calculation' (Crown Copyright 2006), and with the input of Fleet's teachers.